Vol. XI. July, 1896. No. 1.

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WATERWORKS PARKS

A MONTHLY MAGAZINE.

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PUBLISHED BY
MUNICIPAL ENGINEERING COMPANY
INDIANAPOLIS NEW YORK

Two Dollars Per Year. Single Copies, 25 Cents.

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Municipal Engineering

VOLUME XI. JULY, EIGHTEEN NINETY-SIX. NUMBER 1.

EFFICIENCY, ECONOMY AND ETHICS IN MUNICIPAL ENGINEERING.

By Charles Carroll Brown, M. Am. Soc. C. E.

Among the problems likely to arise in the ordinary practice of the municipal and sanitary engineer, the planning of an entire sewerage system is one that is almost certain to be encountered at some time in the smaller cities. The ordinary problem is not difficult of solution, but frequently it takes considerable study to get out the most economical method. Right here the corporation can often save money by spending it freely at the beginning. The process sometimes followed, of advertising for bids for planning a system, and letting the work to the lowest bidder, frequently results in an expensive system, for the reason that the lowest bidder, even if competent, can not afford any but the shortest possible time for the work, and is as likely as not to strike a system which will cost much more than is saved in the preparation of the original plans, to say nothing of omissions and indefiniteness, consequent upon hurried work, and calling for further expenditures for plans. It is much better to look up the record of engineers enough to be able to choose a few who can be trusted to do good work; then, if desired, ask them for estimates of the cost of the work and make a selection, not altogether on the basis of cost. In such case the original plans will doubtless cost more, but the subsequent expenditures will be materially reduced.

A few months ago there was much discussion of the requirement by a city council of a bond from an engineer for faithful performance of his duties in designing a system of sewers to be satisfactory to the council; and another case of demanding a bond from an engineer that a system of heating and ventilation for a school-building would be adequate to the demands made upon it. The requirements are exactly like demanding a bond that your physician will cure you, or that your attorney will win your case. Such methods of procedure show the dense ignorance of the public generally concerning the engineering profession, its true standing and requirements. The engineer is thus put upon the same footing as the contractor, when there is actually as much difference in principle between their positions as between the architect and the bricklayer. The contractor is given a definite work to do, material and methods are defined, and he is required to put the materials together honestly and skillfully. There is little or no opportunity for the exercise of judgment by the contractor, except in the minor details of ma-

nipulation, and a bond is not out of place, as a guaranty of honesty of purpose and experience or skill in manipulation of materials and construction according to plans. The engineer, on the other hand, is given a problem to solve which demands the exercise of judgment which he, by his appointment, must be assumed to have, with education and information sufficient to make it valuable, especially on the technical side. His plan, when prepared, is only one of many possible plans, and the plan he presents is, by that presentation, declared to be, in his judgment, the best under the circumstances of the case. To enter into bonds to make the plans satisfactory to any one, professional or non-professional, is, no matter what his contention, to confess his lack of faith in his own judgment, for he has put himself under the control of the authority he must satisfy. Where this authority is non-professional, the incongruity is apparent. I can scarcely conceive of it being professional.

The reference of the plans to some other engineer for an expression of his judgment upon them is not here condemned, though I give below objections to some of the present methods of doing this. Such reference to other authorities is justifiable by the desire to have the best possible solution, and the combined judgment of several experts is usually better than that of any one. What is objected to is the demand of the contract and the bond that the engineer preparing the plan shall subordinate his judgment entirely to the other authority, even though it may be exactly contrary to his best judgment, or suffer the penalty prescribed. His work is of value, probably more value than the price he would receive for it, and should be paid for, whether entirely acceptable or not, or he should not have been employed in the first place.

Cases have occurred where the first solution offered was not satisfactory, and subsequent solutions have been worked out, independently or as modifications of the first plan, until one was secured that was satisfactory, at least in some degree, but there was no question in any case of refusal to pay for work done, even if the plans were not fully acceptable. I know of no cases where the principle of "no cure, no pay" has been applied or proposed, as flagrant as the cases under discussion. We call a physician a quack if he offers to guarantee a cure on such terms, and know that his guaranty is of no value. We call a lawyer who takes his case on speculation, "no verdict, no pay," very close to a shyster. I can see no material difference in principle in the case of an engineer.

There are many cases where several almost equally good engineering solutions are possible, and the final decision as to some details of plan will be made on other grounds. In some cases these external considerations demand material departures from the best possible solution from the engineer's point of view. These questions are rightfully in the province of the corporation authorities, and the engineer could properly be required to make the plan satisfactory so far as these features are concerned. A bond in such cases is an evident absurdity. As well bond a lawyer to say or do nothing detrimental to the interests of his clients. If the engineer has not standing high enough to make such a bond ridiculous, he has not standing enough to be thought of a

moment in connection with the work. The engineering profession can not permit the city authorities to shirk the labor and responsibility which, without question, belongs to them, by submitting to the requirement of bonds, devised, doubtless, to save the authorities the onus of a possible failure to select a proper engineer. When engineers, as a body, refuse to enter into a public competition for work, in response to advertisements for bids, an additional incentive to this procedure will be removed. As Professor Woodbridge has well said, the requirement of a bond, that the system, as designed, shall be satisfactory when completed, is impossible, from the fact that there is so much indefiniteness regarding the meaning of the term satisfactory, and that there are so many modifying elements of change in materials, changes necessary on account of difficulties met in construction, imperfection in workmanship, lack of competent inspection, changes in conditions, and many others, over which the designing engineer has no control.

The engineering profession is too young and its members have too many of them grown up on the business side of it to pay sufficient attention to the matter of professional ethics. The agitation for a system similar to that among physicians was begun a few years ago. While such a system would probably be too hard and fast to be applicable, there is no question that the standard of professional ethics must be raised. There is no question but that it is being raised, but the process can be hastened materially. When engineers cease cutting each others' throats, recognize the fact that no man knows it all, that specialists should be called upon frequently for assistance, and especially that the world of business will not recognize the standing of the profession and a proper system of ethics until engineers themselves recognize them, promulgate the system, and stand by it, the golden days will be near at hand.

A firm of lawyers is called upon to take charge of an important case. Probably one of the first statements made by them to their clients will be that there are special features of the case in which they will need the assistance of specialists, and such men will be agreed upon. Again, the statement may be made that there is more work in the case than they are able to do, and additional assistance is desired and secured. Consultations with eminent firms will also be asked for. When the case comes to trial, additional assistance may be procured to present the case before the court. Does the client complain of all this? It makes no difference in the principle, though it may in unimportant details, whether he does or not. The case must go on as the lawyers desire, or some one else may take it. And the fees, while sometimes provisionally agreed upon in advance, are finally adjusted when the work is done, and largely upon the lawyer's statement of the case, with previous payments in the shape of retainers, court fees, expenses and on account. Is there any reason, except the apathy of the engineering profession, and the ignorance of clients due to this apathy, why an important engineering question should not be treated in the same way? There is an approximation to it in Europe, more especially in England.

The problem whose discussion is desired could be given to the engineer selected by the authorities, after careful consideration of the

field, and he should feel it no reflection upon his standing to call upon specialists for assistance upon the portions in their particular fields and should feel it his duty, rather than a confession of lack of confidence in his own ability, to call upon one or more of his colleagues for conference as to the features of the case and his proposed plans. The question of fees may include, as in the lawyer's case, a percentage on the amounts involved, and such extra compensation or retaining and consultation fees as may be agreed upon before and during the progress of the work or after it is completed. The large case involves all the principles, and is therefore cited, but any case differs only in magnitude and in details and not in principle.

Such treatment of a case will result in great advantage to every one connected with it. The corporation will secure the best service possible to be found, the engineer in charge will be placed in the best possible position for doing his best work, the other engineers employed will be doing the work for which they are best fitted and will therefore give the most economical service, and the final outcome to the corporation will be a solution of the problem, probably at somewhat increased cost for plans, but of the greatest reliability, and in most cases at sufficiently reduced cost to pay the extra preliminary expenses many times over. Such a system would encourage specialization.

Under the best application of the present system, the engineer prepares his plans and his report. These are presented, and quite probably the engagement is closed. These plans may then be presented to another engineer, or to a commission of engineers, who go over the ground and make such suggested modifications as seem to them desirable. The two reports must then be combined, and in a common case where the original engineer is practically left out, this work is given to still another man. The result is no small amount of variation, and even incongruity in details, much useless labor, often more or less ill-feeling, and much vexation of spirit. The method proposed may bring in the same assistance and consultation, and will result in more complete and congruous plans, especially in details, will reduce the cost of the plans by eliminating unnecessary work, and will, above all, place the various engineers in proper relations with each other, and add to the dignity of the profession and to the mutual good-will of its members. When the commission is simply a committee of consulting engineers to advise the city's engineer it is an exeellent feature.

The young men of the profession are the ones who will profit by the improvement in conditions, and they will profit all the more, and the earlier, for an understanding of the undeveloped condition of the subject and the necessity for improvement, at the outset of their connection with the profession. The sanitary engineer will find his chosen branch in the most backward condition of any.

THE CHEMICAL RELATIONS OF ASPHALTUM.

Prof. S. F. Peckham.

III.

In 1861 M. Leon Malo, who had not long before been made the manager of the works at Seyssel, where calcareous asphalte is mined and mastic is prepared from it for paving, published a memoir upon asphalte, also in the *Annales des Ponts et Chausses*.[1] This memoir has since been published in book form and has become a classic upon this subject.[2]

He commences his discussion of the subject by attempting a "definition and classification of bituminous materials." Science has long since outgrown this classification, which at the time it was made was well done. I reproduce it here in order to show along what lines progress has since been made:

Bitumen	1. In the free, pure state	1. pure, liquid or viscous	Naphtha.
			Petroleum of Baku, Gabian, etc.
			Maltha of the Dead Sea.
			Fountain of Pitch (Auvergne).
		2. Impure, solid	Various kinds of coal.
	2. Mixtures with an earthy gangue		Earthy bitumen of Mexico.
			" " " Cuba.
			" " " the Island of Trinidad.
	3. Mixtures with a quartz ose gangue		Bituminous sandstones of Pyrimont-Seyssel.
			" " " Clermont.
			" " " Bastennes, etc.
	4. Impregnating schists		Bituminous schists of Autun.
			" " " Buxieres-la-Grue (Allier).
			" " " Dauphiny.
	5. Impregnating limestone (asphalts)		Asphalte de Seyssel.
			" du Val de Travers.
			" de Lobssann.
			" de Chavaroche.
			" de Clermont, etc.

At the present time, and in accordance with the suggestions of the late Dr. T. Sterry Hunt, a similar table would be arranged as given on next page.

M. Malo remarks that the most concrete expression for bitumen is *coal* and the most simple expression for bitumen is *naphtha*. These statements are not founded upon any scientific considerations, as I shall have occasion to show further on. Both these tables are wholly empirical, excepting so far as the latter one distinguishes bitumens from pyrobitumens.

M. Malo further remarks: "Every time that in the geological ages a mass of organic matter enclosed strongly has been submitted at the same time to a great pressure and a high temperature, bitumen is formed." He then shows how the cellular tissue of plants, or the muscular tissue of animals may be transformed, the first into coal, the latter into bitumen, *as if* the transforming process always acted in the one case or the other upon the same material with the same result; observing further, that when the bitumen is submitted to a second distillation it produces pure and colorless naphtha, or it is soiled with oxygenated bitumen and called petroleum. He finally

concludes that "we will admit that at some indeterminate epoch some considerable masses of vegetables or animals, buried in sedimentary beds and heated either directly by the central heat, or by the invasion of volcanic currents, have, in an immense distillation, given birth to all the bitumens. It is certain that this gigantic action was exercised in a very varied manner, according to place, temperature, pressure, the nature of the neighboring rocks, the epoch of its operation, and the original material, the product differing in form, appearance, composition and properties. But the mode of formation has been the same throughout and the resulting bodies contain an identical principle, the bituminous principle, which does not resemble any other body, and for which it is not to be mistaken."

Bituminous Minerals.	1. Bitumens.	1. Pure gaseous	Natural combustible gas.
		2. Liquid oils and viscous	Naphtha.
			Petroleum of Pennsylvania, Galicia and Baku.
			Maltha of Bastennes, Alabama, California, Texas, the Dead Sea and South America.
		3. Pure, solid	Asphaltum of the Dead Sea.
			" " Cuba, Grahamite, Albertite.
			" " California.
			" " Utah, Gilsonite.
			Ozocerite of Utah and Galicia.
		4. Saturating sandstones and limestones	Asphaltes of Seyssel.
			" " Ragusa.
			" " Kentucky and Texas.
			" " Utah.
		5. Mixed with an earthy gangue	Pariani (Trinidad pitch).
			Asphaltum of Cuba and California.
	2. Pyrobitumens.	1. Coals	Anthracite.
			Cannel.
			Splint.
			Lignite.
			Peat.
		2. Schists and shales	Schists of Autun.
			Boghead mineral.
			Wollongonite, etc.

This view of the origin of bitumens, while very near the truth, is founded upon conjecture rather than proof, and has led to an assumed identity among all forms of bitumen that has enthroned error and discouraged research, with results that have been altogether unfortunate. Possessed with this idea, M. Malo centers upon the considertion of the limestones saturated with bitumen that occur in several localities in different parts of France. He appropriates the word *asphalte* as a name for these rocks, as sanctioned by usage, forgetting that asphaltum is in France called by this same name.

He describes *asphalte* as "the most rare manifestation of bitumen; it is a rock formed of 90 to 94 per cent. of carbonate of lime, and of 10 to 6 per cent. of bitumen. Its aspect is that of plaster, its color a deep chocolate; when it is cut the cut surface presents a whitish appearance; the grain is fine and when the structure is carefully examined each molecule of limestone is surrounded by a mushy atomic bed of bitumen; each grain is then isolated from its neighbor by a varnish that serves at the same time as an energetic paste between them. When heated this varnish becomes viscous and often even the weight of a block is sufficient to break it into two or more frag-

ments. In winter the bitumen becomes dry and the rock becomes remarkably firm."

He further remarks that the deposits are geographically situated on a line that coincides with the direction of the Jura. From whatever source they may have originally proceeded, the beds lie in the superior portion of the Jurassic formation.

The rock is prepared for use either by crushing cold or by decrepitation. When treated by the first method it is afterwards heated in retorts and mixed with hot bitumen to form mastic. When treated by the second method it is heated on iron plates. The bitumen softens, the mass falls to a powder, which is sifted and the hot powder is applied directly to the street and rammed or rolled into a sheet surface. This last named method was earliest used and is the simplest; but it has always been found difficult by any contrivance to heat the rock uniformly so as to insure freedom from lumps, and at the same to avoid the overheating of any part of the charge, which is to be carefully avoided. He says, that, while the pulverization of the rock by decrepitation is a defective method, it is, and has been, widely used and only waits the invention of a means of uniform heating to become general.

For the preparation of mastic the rock is crushed in a vertical mill, or in a mill resembling a large coffee-mill. The crushed rock is heated in revolving cylinders, or retorts, and thrown hot into pure bitumen heated to near its boiling point. The hot rock decrepitates, and a very intimate mixture is formed, which, after being heated and agitated during six hours, is allowed to cool in circular molds, forming masses resembling a cheese in shape. By this means the rock is metamorphosed into a strong mastic, easily fusible, and quite different from the original material; the action of the free bitumen is, however, only accessory; it assists in the fusion of the rock, and supplies the impregnating oils lost by evaporation.

He adds this pregnant statement: "Whatever be the action of the bitumen added, it is a constant fact, that the closer the geological analogy between it and the bitumen with which the rock is impregnated, the better is the mastic obtained. * * *

"A mastic made with rock abundantly and equally impregnated, fine in grain, to which is added a closely related (congénére) bitumen, is a black body with redish reflections, elastic, infusible in the hottest sun, and having a very agreeable bituminous odor."

He further condemns the use of candle tar, coal tar, and all other refuse material in place of the pure natural bitumen, in the preparation of mastic. He remarks, "that combination which is sought to be imitated in a cauldron by the mixture of a solid and liquid body without affinity for one another, is in the natural asphalte the result of one of those colossal operations of nature that man is interdicted from repeating."

Avoiding the risk of becoming tedious by repetition, I omit the further description of methods, already fully treated in my last paper, and again to be referred to farther on. I wish, however, to emphasize the conclusions reached by this very eminent observer.

That the asphalte of best quality consists of a *fine grained* rock, in which each particle of mineral

matter is enveloped, and separated from its neighbor by a cushion of elastic, adhesive bitumen.

That want of care in heating the rock injures or destroys its valuable qualities.

That in the preparation of mastic, the rock should be softened with natural bitumen as nearly as possible of the same kind and quality as that originally contained in the rock.

That all attempts to prepare a substitute or artificial mastic of asphalt and coal tar, or any other refuse material of similar nature, had signally failed.

These conclusions were reached at the beginning of 1861.

1. Annals des Ponts et Chausses, Series 4 Vol. I, page 69. 1861.

2. L'Asphalte: Son origine, sa preparation, ses applications, par Leon Malo, Baudry & Cie, Editeurs, 15 Rue des Saints Peres, Paris.

ASPHALT LINING FOR WATER-WORKS RESERVOIRS.

*By L. J. De Conte, M. Am. So. C. E.**

Asphalt as a lining for reservoirs has been in use on the Pacific coast for a long time, and its efficiency, durability and economy have been well established. The first attempts made in this direction were confined to patching old, leaky tanks. The experience thus gained was encouraging and led to extending the application to larger tanks and reservoirs. The trouble in regard to the flow of the lining, when exposed to a hot blistering summer sun, then became more pronounced. Many trials and disappointments followed; but improvements followed with experience, until now we may say that the practice of to-day has certainly reached great perfection, although there is yet much room for future improvement. The fundamental principles to bear in mind in all cases whatsoever are as follows:

(1) A reasonably firm foundation to support the lining is necessary; i. e., if the foundation yields too much under water pressure, the lining is likely to be ruptured.

(2) The first coat should be liquid asphalt, so-called, which has great penetrating qualities, enters freely into the foundation soil and takes root, so to speak. This coating has great adhesive qualities which are of great value, but on the other hand it is utterly lacking in ability to stand the sun heat.

(3) The second coat, the sunproof coat, should consist of hard rock asphalt heated up to 300° F. and applied hot. This coating is both waterproof and sunproof, but is utterly lacking in adhesive qualities, and were it not for the first coat underneath could be taken up readily from the floor like a carpet. It is clear then that the first coat is simply a cementing material to hold the outer coat in place.

The foregoing is all that is necessary in ordinary cases, but in special cases where the side walls are vertical additional precautions have to be taken in localities where the sun's heat is intense, as will be seen further on.

*Abstract of a paper read at the annual convention of the American Water-Works Association held at Indianapolis, Ind., May 26, 27 and 28.

The lining generally used in the older reservoirs on the Pacific coast is a poor grade of porous concrete, faced either with a 1-in. layer of high grade sidewalk finish, or else a facing of brick laid with Portland cement mortar. Both these linings are good, provided the foundation material is firm and stable. This is rarely the case in practice. Subsequent settlement often cracks the lining and leakage begins and generally increases rapidly, soon impairing its usefulness. For patching up and repairing such failures, the best lining, beyond all question, is asphalt. It will stand an extraordinary amount of distortion and crumpling, due to settlement of the ground, and yet preserve its watertight qualities.

One of the hardest cases with which the writer has had to deal was a small reservoir at Mill Valley, Cal. Its location is on the flank of a rugged canyon or ravine. One-half of the base was on solid rock and the other half on made ground. Trouble due to unequal settlement followed its construction. The lining of the old reservoir was 12 ins. of concrete faced with a 1-in. coating of high grade sidewalk finish. That portion over the made ground settled, breaking the lining all to pieces. The cracks were repeatedly dug out and filled with new material of the same character, but to no lasting purpose. The leakage became so great that the water company decided to build a new reservoir and to abandon the old one. The new reservoir was built and the supply transferred to the new pipe line. The old reservoir soon emptied itself and a careful examination followed.

The side slopes were nearly vertical. The larger cracks were in the corners and at the foot of the side walls. It was finally decided to try an elastic lining of asphalt. Extra precaution had to be taken to avoid the crawling down of the steep side slopes. The specifications required: (1) Cleaning out and filling the fissures up full of neat Portland cement paste. (2) Cutting V-shaped grooves in the new joint filling and refilling the grooves with asphalt mastic (20 per cent. asphalt and 80 per cent. sand) until flush with face of the old lining. (3) The entire inner surface of the reservoir then received a heavy uniform coat of liquid asphalt, as an adherent. (4) The four side walls were then covered with a heavy grade of burlaps such as is used for making grain sacks, anchored at the top and hauled down taut and pressed into the green liquid asphalt. The lower end of the burlaps is made to lap over about 3 feet on to the bottom beyond the foot of the sidewalls. (5) The bottom is then covered with a 2-in. layer of asphalt mastic, put down in two thicknesses, 1-in. each, and well rolled with hot iron rollers. (6) The entire surface of the reservoir was then coated with a first-class hard finish composed of rock asphalt heated up to 300° F., and put on hot, forming when completed an impervious waterproof elastic lining which has, so far at least, stood the hottest summer sun without creeping down the walls. The old tank thus repaired has been constantly in use since September, 1894, and no signs of leakage anywhere—and so far as usefulness is concerned, is as good as new. The contract price for the entire work of repairs was at the rate of 16 cts. per sq. ft. of inside facing.

The success attained in relining

old leaky reservoirs and the economy and dispatch with which the work can be done, all suggested the propriety of lining new reservoirs with asphalt at once, and doing away with the old-fashioned expensive masonry lining to a large extent. Wherever the natural ground at the site is stiff material, capable of giving natural support to the elastic lining under the water pressure of a full reservoir, the simple asphalt lining alone can be applied with perfect success. Even where artificial banks are necessary, if they are carefully made and well rolled in thin layers to avoid undue settlement, the asphalt lining is preferable and cheaper, notably the two larger 22,000,000 gallon reservoirs at Denver, Col., where the contract price for the lining varied from 13.3 to 15 cents per sq. ft. of facing, or, roughly speaking about half the cost of a good first-class concrete lining.

The Linda Vista reservoir in Oakland, Cal., is all in excavation, soil, sandy clay and gravelly seams; capacity 5,000,000 gallons, side slopes 1 ½ to 1. Here the asphalt lining was adopted, and was laid directly on the soil—first a coating of 1.3 to 1 inches of asphalt mastic, as before mentioned; and second, an outside hard finish of hard rock asphalt as a sunproof coating. About two years after, during a hot spell, when the water was low, the mastic lining showed some signs of creeping down the slopes. An outside layer of asphalt and burlaps, covered by a hard finish of rock asphalt, completed the repairs and stopped the creeping entirely. It is now four years old, and the entire cost was 15 cents per square foot.

A great deal has been said and written about the troubles experienced at Portland, Ore., reservoirs, in some instances having a tendency to give asphalt lining a black eye. It has taken me some time to collect the following interesting facts relating to these reservoirs. I thought it proper to submit the same to the water-works engineer for correction and amendment such as he saw fit to make. I submit them now as being substantially correct as far as our knowledge goes. It seems to me that the facts below submitted go to show the remarkable utility of asphalt as a lining under the most trying circumstances.

There are four reservoirs in the system. Reservoir No. 1 is situated in East Portland, 400 feet above low water in the river; capacity, 12,000,000 gallons; location, ravine near top of Mt. Tabor; soil, loam, with sand for first 10 feet, balance cemented gravel; depth, 33 feet; side slopes, 1 ½ to 1. The dam is made of concrete, inner face vertical and backed with earth and stone on the downstream side. The lining is five inches of Portland cement concrete strengthened with a network of ⅜-inch twisted iron, meshes 18 inches square, held in place by anchor bolts driven into the slopes at 10-feet intervals both ways; then a top facing of 1-inch Portland cement plaster sidewalk finish; then an outside coating of hard Alcatraz asphalt (300° F.) put on hot, ⅛-inch thick, with mops and brushes. This concrete lining was partly subdivided by V-shaped joints 3 inches deep, 1 inch wide at the top and tapering to ½ inch at the bottom. These joints extended down both slopes and across the bottom. The intervals between joints are 10 feet. These joints are made by imbedding wedge-shaped boards in the concrete and pulling them out after settling had taken place. They were painted inside

with hot Alcatraz asphalt and then filled flush with asphalt mastic of 80 per cent. sand and 20 per cent. asphalt, both hot when mixed, and rammed hard. The top coating ½-inch thick of course passes over all. This reservoir has been in use continually and has given no trouble.

Reservoir No. 2 is situated on the flank of Mt. Tabor at an elevation of 220 feet. No dam was necessary. Dimensions, 700x250 feet; depth, 20 feet; capacity, 20,500,000 gallons; side slopes, 1½ to 1; top soil, 8 feet loam; middle, 8 feet yellow clay and boulders; bottom, 8 feet rotten rock and clay. The easterly half of the elevation was dug down to the original grade. Rock excavation was slow and would probably delay work another season, hence a change in the original grade of the bottom, whereby it was raised 5 feet higher and compensating for the same by raising the banks 5 feet. This change led to back-filling the easterly or first half of the bottom excavation, thus raising it up 5 feet to come flush with the new grade adopted. The material used for back-filling was taken from the westerly end and was largely boulders, rotten stone and clay to fill the voids, and a top layer of clay. This whole area of made ground was then rolled with a 15-ton roller and made flush with the rock foundation, extending throughout the westerly half of the bottom.

The lining consists of a layer of sand 2 inches thick, two courses of hard burned brick dipped in asphalt and laid flat with courses at right angles, and breaking joints. The joint between the courses, like the top face, was well floated with hot asphalt ⅛-inch thick. After completion the reservoir was filled with water, but after eight or ten days it was noticed that there was a leak somewhere. When the water was drawn off it was found that a large portion of that half of the bottom paving over the back-filling was distorted and in a few places where it was sharply depressed more than 10 inches or 12 inches below grade the lining was broken and leaks created. Elsewhere, although much distorted and unsightly, the lining did not appear broken. All of the west half of the bottom underlaid by solid rock was intact, although there was some settlement in places. The side slopes were entirely free from breaks although the continuity of the faces was marred by numerous depressions which marked the sights of blasts set off by excavators. The holes in the bottom are now filled with good puddle, from time to time, and the leakage is of no importance. The reservoir is in constant use.

Reservoir No. 3 is situated in the City Park, West Portland; dam, concrete; capacity, 16,500,000 gallons; side slopes, 1½ to 1; depth, 49 feet; ground, stratified clay, the seams next the main hill being wet or springy. After excavation was completed this ground showed some signs of sliding, and a large amount of soil was removed from the hill above the excavation, and the side slope re-established. The lining is a five-inch layer of Portland cement, concrete and twisted iron, covered with one-inch concrete sidewalk finish, one-eighth inch of hot Alcatraz asphalt. After completion of the reservoir the ground continued to crawl down-hill, developing large concentric waves or wrinkles in the bottom paving, and horizontal and vertical cracks in the slope lining above. A massive buttress of Portland cement concrete was built at the top of the slide, extending half-way up the

side slope. No leaks were developed in the lining below the top of the buttress, although it presented an unsightly appearance. Above the buttress, however, the paving suffered further distortion, and many fissures appeared, superinduced by wet weather. The reservoir is now in use, being half-full only. The lining is in good order, except at and near the landslides.

Reservoir No. 4 is situated immediately below reservoir No. 3, and in the same ravine. Capacity, 17,700,000 gallons; depth, 40 feet; side slopes, one and one-half to one; ground, stratified clay, with seams of wet gravel in places. The lining is first an eight-inch layer of good puddle over the entire area, then the same as for reservoir No. 3. The trouble was also caused by a landslide coming down the hill, as in the case of reservoir No. 3, but more pronounced. The reservoir has been used only part of the time.

The success met with so far has naturally led to further effort in the direction of economy. The cost per cubic unit can of course be reduced by admixture of broken stone with the asphalt precisely as in ordinary cement concrete. The new 40th street reservoir in Oakland is now being lined with four-inch asphalt concrete. Depth, 20 feet; side batter, two horizontal to three vertical; capacity, 4,000,000 gallons; soil, stiff sandy clay, and seams of sandy gravel. The surface of the ground is first covered with cheese-cloth stretched taut and painted with liquid asphalt. The asphalt concrete is then laid on hot behind suitable moldboards and rammed hard, beginning at the bottom of the slope and working up. In regard to the Portland reservoir it is proper to state that they are only used for storage purposes, the main supply being distributed through the gate house direct, so that the injury to the reservoir slopes does not at all interfere with the delivery of water or operations of the new supply.

Although the efficiency and economy of asphalt for lining is now well established, nevertheless there are some able engineers who still question its durability. This is a point upon which opinion has little weight—time alone can settle the matter. But it so happens, there now exists on the Santa Barbara coast a natural demonstrative proof of durability which to my mind will outweigh all the opinions of to-day that can be brought against it. I have reference to the asphalt dike or natural breakwater which projects out into the Pacific Ocean some half a mile. This dike formerly filled a fissure in the country rock. The stone on either side has been worn away in past ages by slow erosion and the dike stands out in bold relief, like a quartz ledge.

In regard to the strength of asphalt it may be stated that an asphalt brick $2\frac{1}{4} \times 4 \times 8$ inches, laid flat, was subjected to a pressure of 110 tons continued for 24 hours. Its thickness was reduced to 2 inches without cracking or breaking. As to tensile strength, briquetts made of asphalt break with a strain of 480 to 490 pounds per square inch.

Asphalt concrete as now used shows when broken a natural fracture passing right through the small stone used as an aggregate. This concrete is not only stronger than Portland cement concrete, but also is impervious to water, a quality of inestimable value, and very hard to obtain with ordinary concrete. There is another important feature

which I have omitted to mention, the natural solvent pure bitumen used in preparing the materials. This is a practical item of inestimable importance. It is obtained easily in California by taking bituminous sand, placing it in a suitable drain, and turning in hot steam from a boiler near by, using a steam hose and nozzle, etc. As a result the sand settles to the bottom of the hot condensed steam water, the pure bitumen floats on the top, and is skimmed off while the hot water and sand are run to waste on the beach. The solvent, more commonly used in the eastern states, is a petroleum residuum, which is objectionable for two reasons: (1) It is soluble in water, and (2) it is not a true solvent, inasmuch as after the mixture is made the asphalt has lost its original character to a certain extent, and can never regain it. On the contrary, the natural solvent, pure bitumen, is always the best to use for two reasons: (1) it is insoluble in water; (2) it is a true solvent, the two ingredients are not affected by mixture, the asphalt maintaining its original character. Practical men can not pay too much attention to this point.

WHY WATER METERS SHOULD BE USED.*

In estimating the daily consumption of water by any large community due consideration should be given to the method of assessing the rates for water. If this is by survey, the consumption will usually be large, and if by meter, the consumption will not only be relatively low, but bear a more just relation to the real requirements of the consumers.

To secure the best possible information on the present daily per capita consumption of water from public works in this country, inquiry has been made of twenty-nine of the largest cities of the United States for the rates of consumption during 1895. From this it appears that for the fifteen principal cities of the country embraced in the list the average daily per capita consumption for the past year was 124 gallons. An examination of the list of cities from which statistics were obtained reveals the interesting fact that in those, like New York, Providence and Milwaukee, where the larger part of the water is furnished to consumers through meters, the per capita consumption is low, while in cities, like Washington, D. C. (which has a gravity supply), that furnish water by survey rates the per capita consumption is usually high. But one exception to this condition is found in the city of St. Paul, which is furnished with a gravity supply, but can not be regarded as a metered city. Of the fifteen principal cities in the list, the following, according to the last issue of the Manual of Water-Works Statistics for 1891, are the percentages of taps metered in each:

New York	20.30 per cent.
Chicago	2.53 "
Philadelphia	.30 "
Brooklyn	2.53 "
St. Louis	8.20 "
Boston	2.00 "
Cleveland	5.80 "
Buffalo	.23 "
Detroit	2.12 "
Milwaukee	31.90 "
Minneapolis	6.33 "
Providence	62 34 "
St. Paul	4.21 "
Louisville	5.63 "
Cincinnati	4.06 "

*Abstract from report of Engineer Commission on water supply for Cincinnati.

With reference to the use of meters, it may be well to state that these are not intended to restrict the proper use of water in any city, but to correct the abuse of the water privilege, and avoid the enormous waste which we know is now occurring in nearly every city where the water is supplied under survey rates.

The same rule that applies to the use of gas from the street mains should apply to the use of water. The theory that the use of water from the public mains should be as free as air is altogether wrong. If the supply of air to any community required that it be pumped, purified, and distributed as is water, then no one can doubt that it also should be subject to such regulation as will prevent abuse of the privilege of drawing upon the public supply.

The pumping, purification, and distribution of water represents a large relative cost to any community, and if one person is permitted to use or waste large quantities at no greater cost to himself than to his neighbor, who is careful to draw only so much water from the public mains as may be needed in the proper supply of his residence, store, or factory, an injustice is perpetrated which affects the whole water-consuming population.

With the use of meters, the present great waste of water through defective plumbing and connections would be avoided. Few consumers, if required to pay for their water by the gallon, would tolerate for a day the large loss which they would have to pay for through neglect of bad connections and fittings in their houses. On the other hand, it is not likely that any one would forego the proper and necessary use of water when the cost to him is less than one cent per hundred gallons.

PURE SUPPLY OF SURFACE WATER.*

By John C. Haskell, Supt. of Lynn (Mass.) Water-Works.

Water to be used for quenching our thirst should possess no disagreeable taste or odor, no color, and should not be dangerous to health.

We have in the basement of the City Hall, in Lynn, a laboratory in which biological examinations are made weekly of samples of water taken at points one foot below the surface and one foot above the bed of all our ponds.

Although this is a subject of great importance, and one which covers a wide field for special study in different directions, it is one which has not been given the prominence it deserves, and is not as yet perfectly understood.

The standard of purity should be kept as high as possible and to accomplish such a result it is necessary to know what produces the various changes and the best methods to be followed for their prevention.

The usual course pursued by expert engineers, until within a few years, in providing a system of water supply by artificially storing water in a reservoir formed by constructing a dam across the valley of a small stream or river, gave very

*Condensed from a paper read before the New England Water-Works Association, June 12, 1896.

little thought as to the liability of a change in the character of the water impounded therein. Quantity, not quality, was what was wanted.

From the first of these artificial reservoirs it was found that at times it possessed very disagreeable qualities.

Some of the organisms in our waters are not injurious in any way to the character of the water, except to sight. Others, although invisible to sight, are disagreeable both in taste or odor. Some possess all of the disagreeable attributes. While it is generally claimed that the presence of large amounts of decaying vegetable organisms in our waters is not dangerous to health, it is certainly very disagreeable, and in my opinion not altogether harmless.

The dangers to a water supply from swamp drainage should be eliminated as far as possible by separating the swampy portion of the watershed from the hilly, by ditches at the edge of the swamps sufficient in size to carry the water from the upland around the swamps. Where the depth of soil will admit, the water table of the swamp should be lowered by means of ditches to the gravel or sand below the soil, thus requiring the water to simply pass downward a few feet through the soil to the gravel below, instead of a long distance through the surface of the swamp.

A practical result in this direction is shown as resulting from work upon the watershed of Walden Pond in 1895, which reduced the color of the water in the pond, as shown by the weekly examinations, from 76 in 1895 to 43 for the corresponding time in 1896. This reduction in color is perceptible and can be expressed in figures; undoubtedly the diminution in taste and odor, which can not be shown so clearly, was greater.

Natural ponds are not free from periodical changes in character of water, and there is no certainty that their water will be pure at all times. Our experience is based upon artificial reservoirs.

The water supply of Lynn is taken from the impounding reservoirs. The first two constructed, Breeds and Birch ponds, were largely purified by natural causes, but in Walden and Glen Lewis ponds it has been different, no perceptible improvement being shown in the latter. We attempted to improve the summer condition of the water in Walden pond. In our endeavor to accomplish this result and with a view to ascertain as nearly as possible whether the results to be obtained by removing all soil from the bed of the pond might not be equally well subserved by a covering of gravel or sand over the soil to a sufficient depth to effectually destroy its pernicious effect on the water, a portion of this area, containing mud from 15 to 35 feet in depth, was selected as an area upon which the expense of removal would be practically prohibitive; also one where the chances of failure to secure good results were most likely to be found.

The surface of this area was mud, with water standing near and upon a portion of its area, it being of such a nature that gravel would readily sink to an unknown depth. All stumps within this area were allowed to remain. Other stumps were removed from the adjacent area, from which all soil was to be removed and placed over the muddy area to form a more stable bed than the wet soil, finally covering all with about one foot of gravel. The bed of the pond was

burned over, and was exposed to alternate freezing and thawing through the winter. The success attendant upon this effort is shown from the fact that the water became unfit for use on May 25, 1893, and on May 23, 1894, but in 1895 the water remained a good, potable water, remarkably free from algae growth, until July 10, a sufficiently late date to furnish the needed supply, when it was again wasted to permit further work in this direction. An examination of the different exposed areas showed an equally good appearance of the covered areas and those from which all soil was removed.

Immediately after the bed of the pond was exposed to view, samples of the gravel from the areas cleared and soil from the areas not disturbed, were taken to determine as far as possible what advantage was gained by our labor.

These samples, in equal numbers from the sand and soil, were collected at points not more than two feet distant from each other, and placed in a dish of water to develop all animal and vegetable life that ocuild be germinated. In the specimens taken from the soil, most of the species of organisms previously found in the waters. of the pond were well enough preserved to commence an active growth. The samples of gravel contained practically nothing, although gathered in such close proximity to the others.

While the removal of organic matter from reservoir bottoms is a step in the right direction, it is possible that the matter brought into the reservoir, in the form of wash from fields, may furnish food and resting places which will contribute to the development of troublesome organisms.

FINANCIAL MANAGEMENT OF WATER-WORKS.

Mr. Freeman C. Coffin, in a paper read before the New England Water-works Association, discussed various questions relating to the financial management of water-works, such as whether municipal plants are self-sustaining and whether the rates charged private consumers are too low, thus throwing the burden of expense on the tax-payer rather than the consumers, and piling up bonded indebtedness where improvements should be paid for from the revenues.

Mr. Coffin defined some of the terms entering into his discussion on account of the divergencies in water-works book-keeping. This was especially necessary as regards the construction and maintenance accounts. Under construction, assuming the works already built, Mr. Coffin would include all extensions embracing main and service pipes, all improvements and all renewals on account of deterioration or insufficiency. Under maintenance would come salaries of permanent officials and employees, care and repair of plant, other operating expenses, interest and depreciation.

Revenue should include all sums derived from private consumers, in addition to which the works should be credited with a sum equal to the actual expense of providing for fire protection and other public purposes. This is necessary because consumers and tax-payers are not identical, and

because the cost of construction and operation is increased by making provision for fire protection. The increased cost of works due to fire protection, Mr. Coffin estimated at 100 per cent. each for pumping machinery and mains, 33 per cent. for pumping stations and 75 per cent. for reservoirs or stand-pipes. The increase in maintenance he put at 100 per cent. for care and repairs of pipe system, 33 per cent. for pumping expenses and 75 per cent. for interest and depreciation. The quantity and quality of the original supply and the office expenses he did not consider as increased on account of fire protection. The total increase in the yearly charges, operating and fixed, he put at from 33 to 43 per cent.

He stated that where not over 50 per cent. of the total revenue was raised by direct taxation a proper public charge for fire protection would not be exceeded.

As a figure for general application, three gallons per capita was given as the use of water for public purposes, other than fire protection, and 15 to 20 cents per 1,000 gallons as a fair price for such water.

The above and other principles set forth in the paper, Mr. Coffin had used in tabulation and computations relating to some 65 waterworks, mostly in New England. From a vast array of figures, Mr. Coffin showed that of 52 works there were 14 in which the revenue from private consumers is sufficient to meet the total annual expenditure, including interest and depreciation; 19 in which the sum of this revenue and that estimated for public purposes, but not including fire protection, will meet the total expense. For the remaining 33 plants there would be deficiencies ranging from 0.8 to 57.3 per cent., but exceeding 50 per cent. in only four cases, the maximum amount allowed as chargeable to fire protection.

The conclusion reached by Mr. Coffin is that generally the rates charged private consumers are, as works are now operated, high enough.

PUMPING PLANTS FOR SMALL TOWNS.

The question of the power required for pumping water for supplies of small towns is a very important one in its relation to the cost of maintaining the works. The expense of pumping is a very large part of the expense of maintenance, and where the amount of water to be supplied is small the expense of attendance is a large part of the expense of pumping. In such cases the cost of attendance is likely to bear too great a ratio to the total cost of maintenance and to reduce the profits to a minimum, or to produce a deficit to be made up by an extra appropriation from the town authorities in case of a public supply or an increase in rates or final bankruptcy in case of a private company. Anything which will reduce the expense of attendance by making it possible to assign the duties to some one already employed, whose time is not fully occupied, is therefore a direct gain. Sometimes it will make possible the construction of works, the success of which would otherwise be very problematical.

Perhaps the town has, or wishes

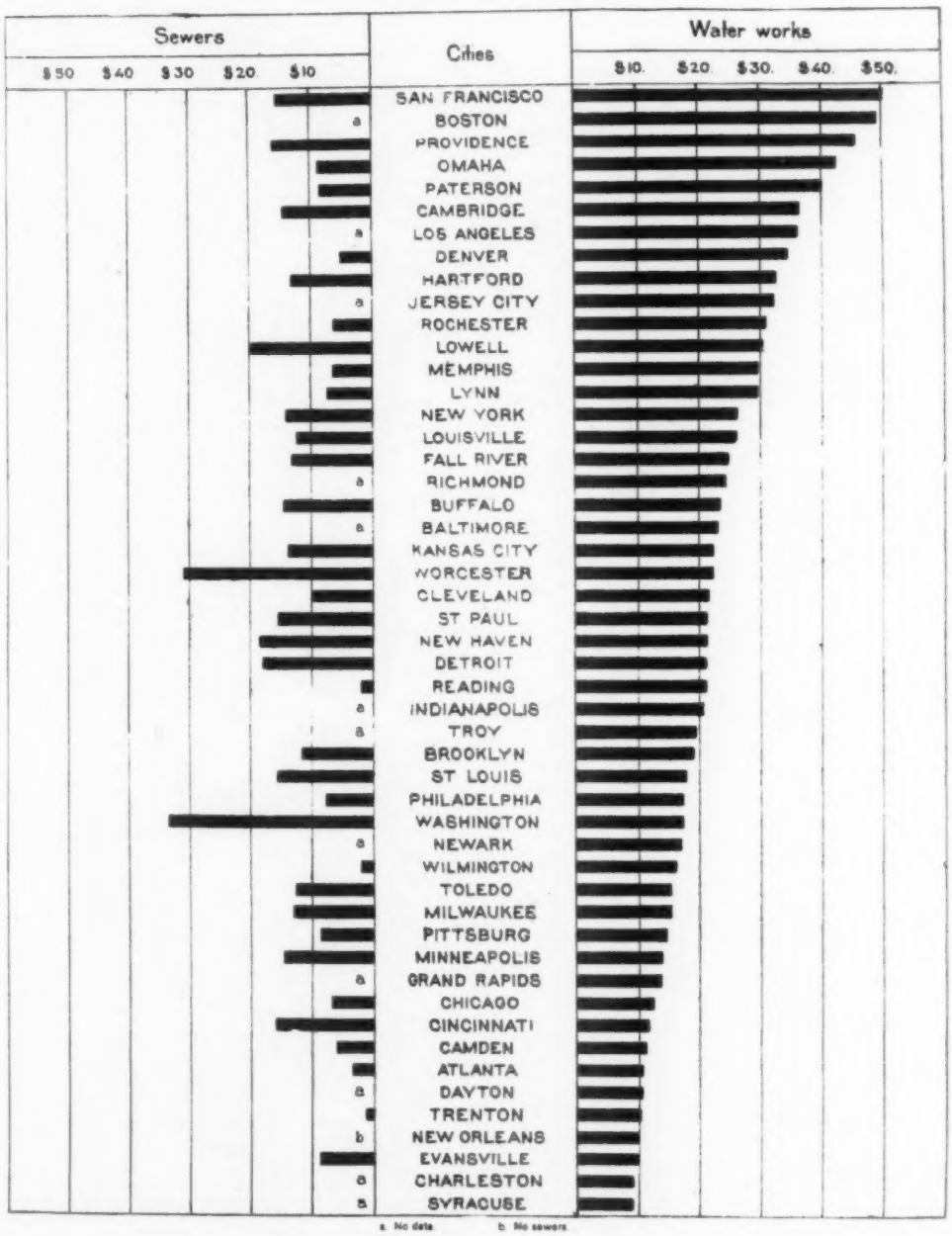
to have, an electric light and power plant of small dimensions. In such case the attendance on the pumping plant will cost nothing extra, for there will be only the additional dynamo and the pump to look after, and the duty will not materially increase the labor of the attendant upon the electric light plant. No additional power will be required in the electric light station if there is moderate storage capacity in reservoir, tank or standpipe, for the lighting plant will not be called upon for its load when the call for water is greatest, and thus the power can be utilized for pumping when it is not demanded for lighting. The engine will be worked at its maximum efficiency by thus keeping its load near its computed power and the actual cost of additional fuel for pumping will be very small. In fact, for quite small plants, the pump need not be run except when the power is needed for lighting, the pump being run only when the maximum load is not required for lighting, in which cases the cost of additional fuel will be inappreciable. Ample provision must be made for water at fires, either by furnishing adequate storage capacity, or by providing extra engine and dynamos, which can be put in operation on short notice. Such extra machinery should be provided for the lighting plant for use in case of a breakdown, and when so provided will not need to be added to for purposes of water supply. One advantage of the electrical power is that in case the water is procured from wells some distance from the town, the power-house can be located at the most convenient and economical place and the power transmitted to the dynamo at the pumping station by wire. Occasional visits of the engineer to the pumping plant will be necessary, even if proper apparatus for giving report of the work going on there are provided, so it is advisable to to have the two plants as near together as possible if they can not be in the same building.

Gasoline engines are now constructed which are reliable and very economical in operation and require very little attention, and the manner of operation is very readily learned by a person of ordinary intelligence. The duty of attending to the engine can be imposed upon any of the town officers whose official cares do not take his entire time, and the additional pay required will be very small. In case of fire the engine can be started up in a very few minutes, and give any desired pressure and supply, within the limits of its capacity. For such a plant less storage capacity would be needed than for the first plan mentioned, if extra machinery is provided to use in case of failure of the ordinary set from any cause.

Where natural gas is obtainable, the problem is simplified still more. Engines and pumps directly connected for use with natural gas are manufactured and are even more economical of fuel and attendance, than the gasoline engines.

MUNICIPAL ENGINEERING will shortly publish descriptions of some plants of each sort, and shall be glad to receive from correspondents any data as to the economy of small power plants of any sort, for publication in connection therewith.

DIAGRAM OF WATER-WORKS AND SEWERAGE STATISTICS.



SEWAGE DISPOSAL IN PLANS FOR NEW SEWAGE SYSTEM.

The subject of sewage disposal is becoming of greater importance each year, especially in the inland country, where many of the smaller cities and towns and some of the larger ones, must discharge their sewage into small streams. In the early days of a sewage system, before many house connections are made, the raw sewage does not produce a serious effect, but as the use of the system increases, complaints from parties affected by the nuisance created come in. In the designs of a new system, the matter of sewage purification must be carefully studied for the particular circumstances of the case, and provision made for the future construction of some system of purification must in most cases be made, if the purification is not provided for when the sewer system is constructed. Serious errors in plans have frequently been made in neglecting this matter, and large expense for pumping or long extension of outlet is found necessary, sometimes on account of failure to recognize the future necessity of a purification plant. Two cities are now enjoined from using their new sewer systems unless proper provision is made for abating the nuisances created by discharging the raw sewage into smaller streams, and must take up the question anew, and construct the works hastily, and at great expense, because proper provision was not made in the original plans. In each case the probability of the production of nuisance was recognized by the city authorities, but the expense of the works seemed large, and the trouble seemed to be one of the dim future, and the matter was therefore pushed on to their successors, who now find themselves obliged to meet the question under circumstances unfavorable both to careful, deliberate action and to economical construction.

SOME FRENCH CEMENT WORKS.

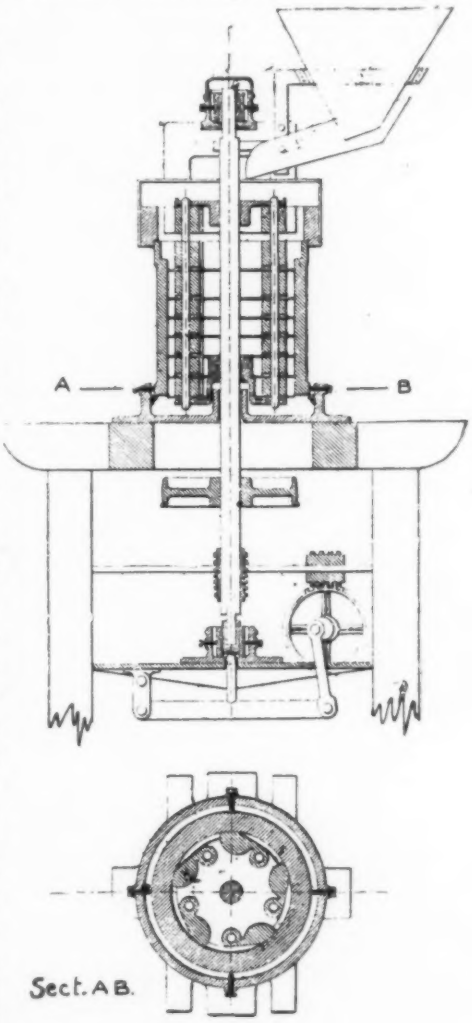
H. K. Landis, E. M.

In the industrial world of to-day, which is so eminently the embodiment of Darwin's principle, the survival of the fittest, it is not the old philosopher's dictum, "man, know thyself," as much as it is the warning of to-day, "man, know thy neighbor," which determines individual success. There are few industries in this country which are not forced by competition to constantly adopt more economical methods, and as these methods are entirely too expensive to be evolved from experiment alone, every enterprising manufacturer makes a point of being well informed upon the methods and causes of success of his neighbors at home and abroad.

A standard label no longer passes a barrel of cement, but it is tested both for the requirements it will and will not have to fill in practice; and consequently if not fine enough, other grinding and sifting methods must be adopted; if not evenly burned or mixed, other kilns and mixers must be tried. And the first question always is:

What are the Belgians, English, Germans, French and Swedes doing? Why? Because they ship their cement from the works to the coast, load it on steamers and sailing vessels, bring it to New York, unload and store it, and yet sell it at the doors of our works at a competitive price. Our manufacturer at once explains this condition as due to "cheap labor;" but it is not entirely cheap labor. If we look into continental methods carefully we will see what a wonderful amount of attention is given to details and the great efforts which are made to get the factories into a swing, as it were, of steady and uniform work. A number of our industries are making competition with Europe very keen, but most of them are doing it with European types of machine. The last kilns built and the latest grinders put in are Belgian, the latter being imported. We thus see that while we are trying to meet competition at home it is well to see how Europeans attain such economical results. Let us take for example the French cement makers whom we hear little of. Though the works at Grenoble, Boulogne sur Mer are interesting we will take for our description those works located at and near Lafarge, on the banks of the Rhone. They are operated by the société J. & A. Pavin de Lafarge, and include the works known as the *Usine de Lafarge, Usine du Teil, Usines de Cruas* and the *Usine de Meysse*, all located within a radius of six miles and using the same material and methods in each.

The remarkable properties of the hydraulic lime of Teil were known and the lime used in the seventeenth century, but the actual manufacture on a methodical scale began in 1830, when the two old kilns, seventeen feet high, were raised and two others built. In 1840 the annual production was 3,000 tons, which increased in 1870 to 80,000 metric tons, and the works have now an annual output of about 200,000 tons of hydraulic lime and cement, showing an uninterrupted



THE LUBAC MILL.

and cumulative growth. The product is shipped largely to Italy, Spain, Russia, Algeria, and the United States.

The peculiar character of the rock is shown by its containing scarcely a trace of alumina and never as much as 1 per cent. of

oxide of iron; the rock is very uniform in composition, numerous analyses indicating a content of silica of from 14 to 18 per cent., and lime 48 to 44 per cent., while the deposit will not approach being exhausted in a century. The stone is quarried by tunneling into the face of the rock and depositing in a "mine" about 12 tons of powder, which will displace about 200,000 cu. yds. of rock, at a cost of probably 3 cents per cu. yd. The large blocks must be blasted again; commercial muriatic acid is used to dissolve cavities into which the dynamite is placed, 15 pounds of acid being required to lodge in place a little over two pounds of powder. Very few accidents occur, owing to the care that is taken, there being less than one serious one in three years; in nearly all cases they are due to carelessness and not to method adopted. These smaller blocks are broken up by ordinary drilling and blasting and then broken by sledges and hammers into pieces a little over two inches in diameter. About 17 cu. yds. of this stone, weighing 1.6 tons, produce one long ton of burned lime. One man will bring to the kilns and charge 10 cu. yds. of stone.

Continuous kilns are used which are said to be models of their kind. They are 41 feet high above the grate, have a capacity of 98 cubic yards, producing about 18 cubic yards of lime per full day; the stone passes through the furnace in three days. The section and views here given will explain the method of construction in detail. Alternate changes are made of 1.6 tons of stone and 0.11 ton poor coal, which are only interrupted by Sunday or hard times; in such cases the kiln is closed by a cover, as shown in the cut. One man attends to four kilns. The kiln men receive $1 per day; the quarrymen 80 cents to $1, and the others 60 cents to 70 cents per day.

HYDRAULIC LIME.

After the stone is calcined and cooled, it is slaked, and this requires considerable care, as it will begin to set if too wet, and be incompletely hydrated, thus injuring the lime-lasting qualities of the product. So much importance is attached to this operation that many expensive tests have been gone through, and the following method, though expensive and hard on the workmen, is now used. The burned lime is wetted in the cars, spread upon the ground about four inches deep, and watered with sprinklers until thoroughly wet and banked up to a height of about seven feet. Here it remains, covered, for from eight to twelve days, until it is thoroughly hydrated and powdered. The water of hydration absorbed is about 7 to 8 per cent., but must not be beyond; the parts too rich in silica remain hard, and are removed by a No. 40 screen first passing over a two-inch grating; this silica sand, however, was not found to improve the hydraulic lime produced, and so the best is incorporated with the lime, increasing its index of hydraulicity and strength. The sand from which the Portland cement is afterward made, is prepared by a preparatory crushing or cleaning, and then by pulverizing with millstones and passing over a No. 50 screen, what goes through, being then mixed with the ground lime. Notwithstanding this grinding and bolting, the hydraulic lime can be sold in 110 pound sacks at the works for $2.50 per long ton. The commercial product analyzes as follows:

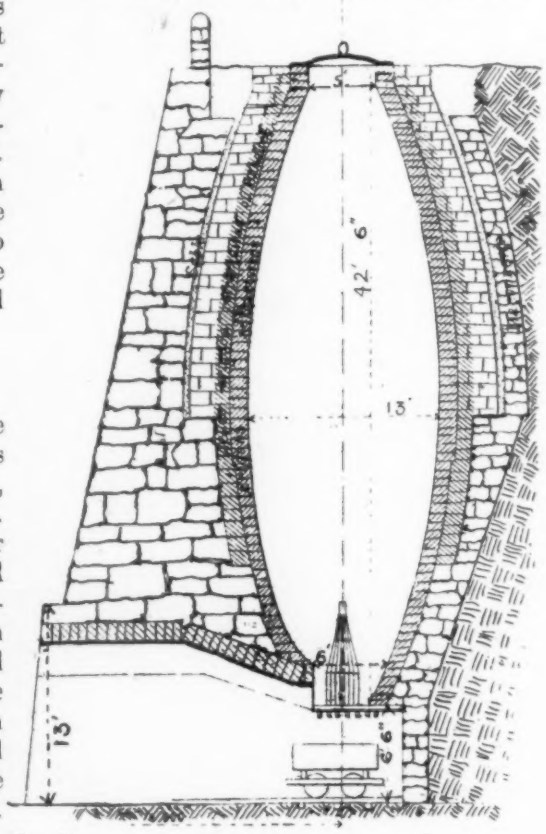
Silica	23.6
Alumina	1.4
Peroxide of iron	.8
Lime	64.7
Magnesia	1.4
SO_3	0.5
Loss by ignition	7.6
Total	100.0

$$\text{Index of hydraulicity} = 0.39 = \frac{Al_2O_3 + SiO_2}{CaO}$$

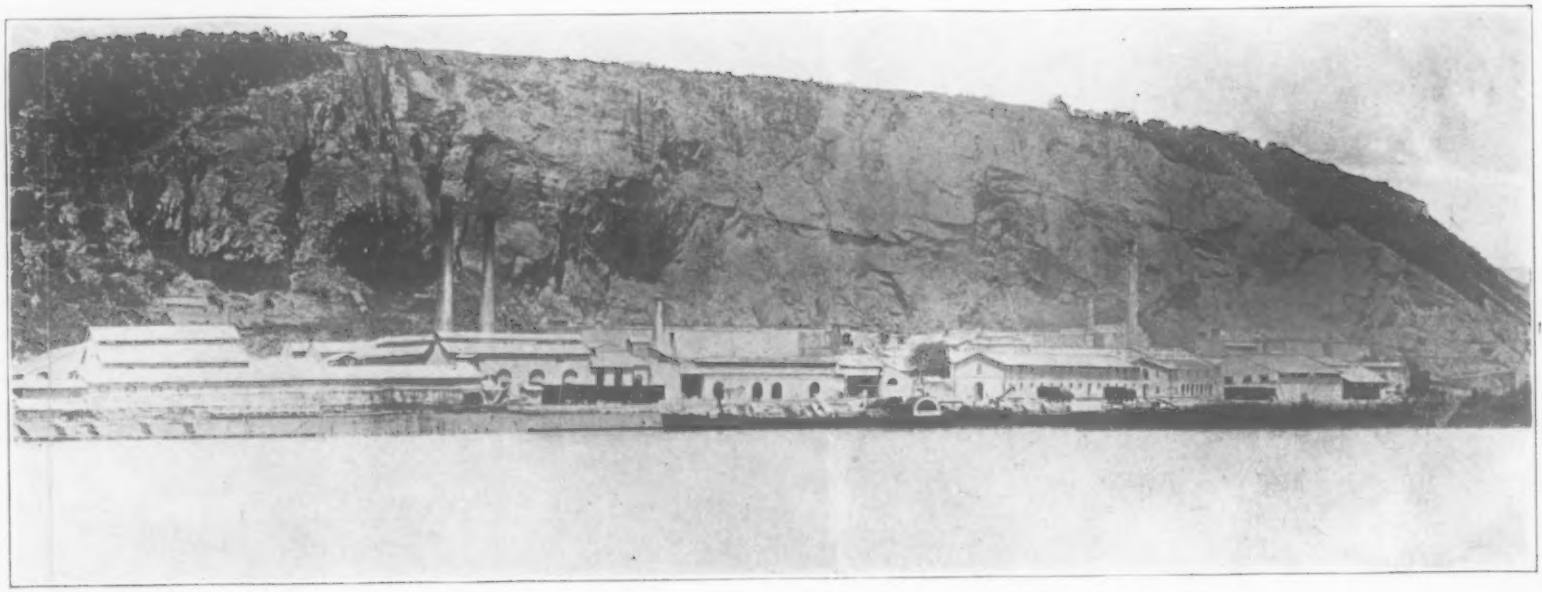
The characteristics of this material are vastly different from those of natural hydraulic cement, in that it is slow setting. It also stands the action of sea water very well. Extensve improvements in piers, sea walls and jetties have been made with it. It is also used for mortars, concrete work, beton work on land and sea, plastering, etc.

CEMENT.

Of the hydraulic lime there is produced by these works about 160,000 tons annually, and but 40,000 tons of cement. This cement is slow setting, or a true Portland. Most natural cements partake of the peculiarities of the rock from which they are made; being burned at a moderate temperature, the product sets rapidly but when the temperature rises, instead of producing a Portland, we secure simply a poor quality. Having the necessary ingredients at hand in their extensive quarries, an experimental works was built containing 20 pairs of millstones and 40 bolts, with accessories, requiring 550 horse-power to run them. The hydraulic lime is treated as before and the silicious sand extracted from it, ground under the millstones, as explained, the part passing through a No. 50 mesh being reserved as sand cement. This is then spread in heaps in a shed, where the moist air hydrates the remainder of the lime, converting it into a hard, slightly yellowish efflorescence, which, after four to six weeks, is removed by a No. 50 screen. The residue of lime is already strongly silicious, and after grinding and sifting through a 150 mesh, it acquires a setting property sufficient to use it in the white special grade of cement. The ingredients which have not been obtained, as already described, are ground in the Lubac mill until they pass a No. 100 mesh. This grinding requires particular care



SECTION OF CALCINING KILNS.



The Quarries and Works at Lafarge, France, the River Rhone in the Foreground.

and many rules have been formulated to govern the rapidity of feeding and revolutions per minute. The residue going over the 100 mesh bolt is exposed to the air and then ground again in the Lubac mill.

The apparatus is composed essentially of a white cast-iron cylinder placed upon a cast-iron base. It is regulated by a pressure screw and has movable *palettes* or grinders strung on vertical rods running through horizontal circular plates which are placed between a set of five *palettes*, as shown in the horizontal section. These rubbers or grinders are made of chilled cast iron, and rub against the inside of the fixed cylinder by reason of centrifugal force. The central shaft is attached to the circular plates and is revolved by means of a pulley under the cylinder. The path of the grinders is changed by means of two endless screws, cranks, levers and a pin butting against the lower extremity of the shaft as shown. The shaft makes about 180 revolutions per minute, taking with it the *palettes* which rub the sand and lime between themselves and the cylinder. The up and down movement prevents the wearing of grooves on the inside of the cylinder by the *pallettes*. From an automatic hopper feed the material drops successively from one plate to the other until the lower range of *palettes* have done their duty and the fine powder drops down to be screened to No. 120 mesh. On account of its origin the cement has a light grey color, and owing to the extreme care taken that no unslacked lime shall enter, the cement does not deteoriate with age. This last property makes it very valuable for pier and other foundations under water.

It must be noticed that this Portland cement utilizes what would otherwise be waste upon which work has been done, and from which no return came. If we look into the history of coke by-products, sulphuric acid, alkalies, sulphate of iron and copper, etc., we see the same systematic economy practiced. The same economic spirit is as apparent in the handling of the men to get the best work possible from them for small wages, as in the smallest detail of management or process, and the enterprise manifested in finding new uses for the product.

The general composition of this Portland cement is:

Silica	28.2
Alumina	1.7
Per ox. of iron	1.3
Lime	60 8
Magnesia	1.7
SO_3	0.3
Loss by Ignition	6.0
Total	100.0

$$\text{Index of hydraulicity} = 0.49 = \frac{Al_2O_3 + SiO_2}{CaO}$$

according to Vicat:

Or according to Gin and Leleux

$$= .50 = \frac{Al_2O_3 + SiO_2 + F_2O_3}{CaO + MgO}$$

Alumina and iron are very low, as compared with other first-class French cements; in fact this by-product cement ranks next to the Grenoble and Boulounais cement in production, and is making a particular market for itself in the field of mosaic and art tiles. The company are making a white cem-

ent made of white lime and white sand, which is capable of a good polish, and makes articles resembling white marble.

HENRY K. LANDIS, born near Lancaster, Pa., on Aug. 19, 1865, was graduated from Lehigh University as Bachelor of Science, in 1890, and Engineer of Mines in 1891. He was employed by the Pennsylvania Steel Co., at their open-hearth steel plant; was assistant to John Fritz, with the Bethlehem Iron Co., in the construction of their ordnance and armour works; was engineer for the Lehigh Zinc and Iron Co., while designing improvements in ore treatment; professor of mining and metallurgy in the Missouri State University; editor in charge of *The Mineral Industry*, for 1894, with the *Engineering and Mining Journal;* and an editor on the staff of the *Engineering Magazine.* He is a member of the Am. Inst. of Mining Engineers, The Am. Chemical Society, The North of England Inst. of Mining and Mechanical Engineers, etc., and is a contributor to various technical publications.

CEMENT IN CONCRETE.

*By Major W. L. Marshall, U. S. Corps of Engineers.**

It is possible to increase good concrete 200 per cent. over usual practices by prolonged mixing or to materially reduce the quantity of cement used for the same strength. In such experiments in mixing mortars and concretes it is instructive to also examine the mixtures with a magnifying glass. One is astonished to find in mixtures not apparently very wet appearances of rills of not excessively muddy water flowing apparently over the surfaces of the granules. A comparatively short experience with such tests will result in such additions of water only as will allow a smearing over the cement paste of the surfaces, and convince one that water in excess is good so far only as it acts as a vehicle in imperfectly manipulated mixtures and imperfect aggregates in carrying some cement to points which otherwise no cement at all would reach.

The practice is a partial cure for bad manipulation and hasty work, and allows fair results at less cost than with less water, when the same imperfect manipulation and poor aggregates would be used. Prolonged mixing and perfect ramming are expensive operations that in many cases will not be justified.

The amount of water is a question not as to which is the best practice, regardless of cost, but what is the best practice under such and such conditions of labor, materials and limited cost. These conditions may be such as to demand grouting pure and simple, down through all grades of mortars and concretes to the most perfect artificial stones that take as near as practicable water for chemical necessities only. The question of wet and dry mixtures is plainly a question of expediency and cost, and of other special conditions, not a question of best attainable results at whatever expense.

It is noticable that advocates of of wet mixtures under all circumstances ridicule laboratory tests on

*Abstract from paper read before the Western Society of Engineers.

mortars as worthless in concretes, but at the same time produce as their only argument, so far as relates to strength, results of laboratory tests on grout to maintain themselves, even though they are not so maintained until a year or several years elapse after the construction has been brought into use. Many of us have seen poor results from grout as well as from other mixtures.

Similarly advocates of dry mixtures under all circumstances quote the French practice in "béton aggloméré," or "béton Coignet," and see no reason in wet mixtures, but oftentimes have to desert their principles or engage in malpractices.

In this matter no Procustean rule is permissible, but the question, "What is the best proportion of water to be used in mortar and concretes of hydraulic cements?" may be well answered, "Any proportion demanded by the special conditions of the case."

Commenting on Major Marshall's statements, Mr. Henry Goldmark referred to the cement used in sidewalks and cellar floors in Chicago, in which there is a great difference, both in the grade of work and the prices paid. He had observed the making of a cement walk by the South Side park commissioners on Fifty-sixth street, in Hyde Park, last fall. "Their specifications are severe," he said, "their inspection extremely strict, and the results obtained there, and on their older walks, are most excellent, so that it is interesting to know that they do two thing which are condemned by many engineers in the use of concrete for other purposes. They make a very dry concrete, using, it is true, small stones, not over three-quarters of an inch in size. The concrete is bedded on a well-drained base of cinders, which is compacted until it is not over two-thirds of its original thickness. They fill up their molds, which are five inches high, and ram the concrete down to four inches in thickness, making the mixture, as I said before, as dry as it can be used. The result is everything that can be desired, and I think this is in line with experience in other lines of work; that is, that a dry mixture gives perfectly good results where it is used in thin layers, and where it is impossible to ram it very thoroughly. Certainly there have been Coignet betons thus made in this country of Portland cement and sand in layers not over four inches thick, but very thoroughly rammed. After twenty years' exposure, their present condition is absolutely perfect, so that I think Major Marshall is entirely right in saying that the proper amount of water to be added is a question differing with the circumstances of each particular part of work."

THE CHEMISTRY OF CEMENT.

Mr. Uriah Cummings, in an article in the June number of The Brickbuilder, on the manufacture of American cement, gives the following explanation of a plain and practical calculation of the percentage of the various chemical combinations of hydralic cements:

SILICATE OF LIME.

Silicate (SiO_2) is a chemical combination of silicon and oxygen in the proportion of one atom of silicon (Si) to two atoms of oxygen (O).

By reference to the table, it will be seen that the atomic weight of silicon is 28, and that of oxygen is 15.96. Two atoms of oxygen will therefore weigh 31.92.

Thus, 28 + 31.92 = 59.92 = silica. By dividing each number by 59.92 we get the percentage of each.

28.00 ÷ 59.92 = Silicon 46.73 } = 100 Silica
31.92 ÷ 59.92 = Oxygen 53.27 } (SiO2).

Employing the same method with reference to lime (CaO) we find that the atomic weight of calcium is 39.90, which, being added to one oxygen 15.96 = 55.86 = lime.

Therefore

39.90 ÷ 55.86 = Calcium 71.43 } =100 lime
15.96 ÷ 55.86 = Oxygen 28.57 } (CaO).

Silicate of lime is formed by a combination of silica and lime in the proportion of one part of the former to two parts of the latter, the combining numbers of which are as already given.

1 Silica=59.92 }
2 Lime (55.86×2) 111.72 } =171.64.

59.92÷171.64=Silica 34.91 }
111.72÷171.64=Lime 65.09 }
=100 Silicate of Lime (2 CaO, SiO_2).

CARBONIC ACID.

Carbon (C) 11.97 }
2 Oxygen (O) 31.92 } =43.89.

Carbon 11.97÷43.89=Carbon 27.27 }
Oxygen 31.92÷43.89=Oxygen 72.73 }
=100 Carbonic Acid (CO_2).

CARBONATE OF LIME.

Lime 55.86 }
Carbonic Acid 43.89 } =99.75.

55.87÷99.75=Lime 56 }
43.89÷99.75=Carbonic Acid 44 }
=100 Carbonate of Lime (CaO, CO_2).

SILICATE OF MAGNESIA.

Magnesium 23 9 }
Oxygen 15.96 }
=39.86 Magnesia (MgO).

1 Silica 59.96 }
2 Magnesia (39.86×2) 79.72 } =139.68.

59.96÷139.68=Silica 42.92 }
79.72÷139.68=Magnesia 57.08 }
=Silicate of Magnesia (2MgO. SiO_2).

Among the manufacturers of artificial cements during the past twenty years or so there has been a constantly growing ambition to increase the number of pounds of tensile strain their cement will sustain, expecting thereby to improve the quality of their respective brands.

Goaded on by the universal preference for the brands showing the highest tests, they are striving by every means at their command to attain still higher results.

Many experiments were tried by adding foreign substances in varying percentages, among which may be mentioned sulphate of lime, which still obtains among nearly all the producers of Portland cement.

It is not denied by the manufacturers that by its use much higher short time tests are possible, and they justify its use by their assurance to the public that they do not use too much of it, thereby admitting its harmful character, which is so great that the German society of Portland cement manufacturers publicly advertise that the members of that society are not permitted to use more than three per cent. of this material in their cement.

No one will claim that a mixture of sulphate of lime in a cement is beneficial; on the contrary, it is well known to be harmful, and that a cement is better without it, even though it may not test so high by a few pounds in one-day or seven-day tests.

Its use simply illustrates the unreasoning desire to reach a little higher mark in testing.

Several years ago it was discovered that an addition of lime beyond its equivalent of silica would permit of a higher heat in calcination, which in turn gave a cement the quality of sustaining higher short time tests; and the manufacturers were not slow in availing themselves of this apparent advantage.

And thus the proportion of lime has been gradually increased until to-day there will be found in all brands of Portland cement, as has already been stated, from 2.7 to 3.2 of lime to 1 of silica.

Although it was learned that by increasing the proportion of lime higher short time testing results followed, yet it became evident that such a cement must necessarily contain a large proportion of free lime, which was not considered a desirable result; and to overcome this unpleasant difficulty, some of the leading authorities asserted that the excess of lime was taken up and combined with the alumina, forming aluminate of lime, as shown in the tables quoted from Professor De Smedt, who, it will be observed, gives the combining proportions as silica 34.88 and lime 65.12, the ratio being silica 1, lime 1.86, and the ratio of alumina 1 and lime 2, to form aluminate of lime.

But as the pecentage of lime has been gradually increased, it has been found necessary to establish a new ratio as between the silica and lime, the German authorities taking the lead in this new departure; and it is now gravely asserted that 1 molecule of silica combines with 3 molecules of lime, making the ratio 1 of the former to 2.79 of the latter.

As the modern Portland contains from 2.80 to 3.25 of lime to 1 of silica, the lime,

which is in excess of the new ratio, is conveniently taken up by the alumina, forming aluminate of lime.

Thus for the present, at least, the authorities on Portland cement seem to have the ratio satisfactorily adjusted.

It is probable, however, that some way would be found to show conclusively that 1 part of silica combined with 4 or more parts of lime, should some genius discover a way to produce higher testing results by such a manipulation of proportions.

To show the tendency toward increasing the proportion of lime, which is done solely for the purpose of gaining higher short time tests, it is only necessary to take as an illustration the analysis of one of the foremost brands of English Portland cements; a cement which, twenty years or so ago, commanded the largest sale, and the highest price of any cement in the American markets.

The analysis was carefully conducted by the painstaking and conscientious chemist, Prof. E. T. Cox, while he was state geologist of Indiana.

The constituent parts of this cement, after discarding the non-essentials, will be found in column No. 1 of the following table, and the succeeding percentage of silicates appears in the succeeding columns:

No.	1	b	3	4	5	6	7
Silica	30.89	— 1.65	= 29.24	— 17.44	= 11.80	— 11.57	= 00.23
Alumina	10.82	— 0.94	= 9.88	— 9.88	= 0.00	— 0.00	= 0.00
Lime	57.19	— 3.08	= 54.11	— 32.52	= 21.59	— 21.59	= 00.00
Magnesia	1.10	— 1.10	= 0.00	— 0.00	= 0.00	— 0.00	= 0.00
Totals	100.00		6.77		59.84		33.16		00.23

Silicate of lime, magnesia, and alumina	6.77	
Silicate of lime and alumina	59.84	
Silicate of lime	33.16	
Total		99.77
Uncombined silica		00.23
Total		100.00

AMERICAN PORTLAND CEMENT.

We are in receipt of a letter from one of the foremost authorities on cements, referring to the specifications for the Melan arch bridge at Topeka, which have occasioned so much discussion, suggesting that it has been his impression from the first that the author of the specifications did not mean to refer, in the term "American natural Portland, so-called," to such cements as are made by thoroughly grinding and mixing the materials in a raw state to form the composition to be calcined.

If he is capable of drawing cement specifications at all, and it must be presumed that he is, he knows that there are many true Portland cements made in the United States which can not be styled "natural Portlands," nor "so-called" Portlands, nor in fact anything but Portland, and that, in many cases, of a high grade. But it is the practice of some factories making natural cement to select the best of the clinker, grind it separately and brand it "Portland" cement, and it seems probable that it was to this kind of cement that the writer of the Topeka specifications referred.

There are some natural rocks having the proper proportion of the essential ingredients to make Portland cement, but a slight change in the proportions of the ingredients is followed by a much greater difference in the properties of a Portland cement than the same change would occasion in the properties of the light-burned products, the American natural rock cements. Consequently some of the material put out under the name of "Port-

land" is little better than a good natural cement and it is as much to the interest of Portland cement makers to expose this kind of a product as it is to the interests of cement users. As the American manufacturers of true Portland interpret the term used in the specifications in question it is aspersive to their product, but it was probably not meant to be so interpreted, and it is quite likely that the author of the specifications might set the matter in the proper light at once if he did not choose to be mum.

The specifications were sufficiently severe to occasion some remark, though they do not stand alone in this regard. The hot test specified is similar to that in use by the engineers of the New York Dock Department and by the United States engineers at St. Mary's Falls canal, and in their latest specifications the latter also require a hot briquet test.

CONTROVERSY OVER CEMENT REQUIREMENTS.

A large quantity of Alpha Portland cement was recently rejected in Philadelphia because it contained 2.6 per cent. of magnesia, when the specifications restricted the allowable proportion to 2.5 per cent. The architects in charge of the work were acting in accordance with advice from Booth, Garrett & Blair, who, it is understood, prepared the specifications over which controversy has arisen. W. J. Donaldson, of the Alpha company, contends that the restriction is too severe and that it is aimed at the American Portland cement industry. German authorities are cited in support of the statement, and it is claimed that 8 per cent. of magnesia is safely allowable. Within the last few days new specifications have been prepared by Booth, Garrett & Blair, allowing 4 per cent. of magnesia, but they say that this will be revised, as they have discovered several errors which they wish to correct before publication of the specifications.

EARLY STRENGTH OF CEMENT.

Major W. L. Marshall, of the United States corps of engineers, in a recent article, says that beyond tests for free lime and change in volume, and chemical tests for excessive magnesia and sulphate of lime, he has never been able to find any formulated rule under which weak cement at sixty days should be accepted and a stronger cement rejected, notwithstanding the contention that early form of resistance may be developed at the risk of later failure. There are cements that attain nearly this maximum strength in a short time, and yet an abnormal development of strength on short-time tests would at once call for caution.

THE QUESTION DEPARTMENT.

[By J. W. Howard, B. L., C. E., for MUNICIPAL ENGINEERING.]

PROPER DEPTH OF STREET GUTTERS.

What is the proper depth of a street gutter? *M. J. Dole.*

A simple question with no general answer, except that city gutters should not be deeper than is absolutely necessary. A gutter from four to six inches deep, especially where a street is well paved, is handsome, and becomes an incentive to have the street kept clean. Gutters should not be deep and thus provide a hiding place for filth and refuse. Well paved and well cleaned streets can be crossed at any point. High curbstones or deep gutters should not impede crossing. A curbstone set firmly, with but little above ground, retains its position undisturbed by frost, where high curbs, with deep gutters, would in a few years lose their alignment and vertical positions. A gutter is a local question on each street, and perplexes many persons in many places. No universal rule can apply.

PREVENTION OF ELECTROLYSIS.

Can the destruction of gas, water and other metal pipes by the escaping currents from trolley and electric light wires be prevented?

The difficulty has kept pace with the development of electric roads. It seems impossble to completely prevent it. It has not yet been wholly cured where once started. It will tend to diminish as more perfect methods of construction are adopted. There are three recognized methods of subduing eletrolysis:

First, By perfecting the use of the track as a return. An ordinance was recently passed by the city of Richmond, Va., in which special stress is laid upon this method. The perfecting must be in obviating the resistances to the return current which past methods of track construction have made so common; or, in other words, to facilitate the return flow by the rails, or as desired. The ordinance referred to specifies details which are improvements upon ordinary practice.

Second, By use of two trolley wires, either overhead or in conduits. This is the most complete method, but is not the most satisfactory in many cases, because of the cumbersome and complex arrangement if the wires are overhead; the incentive to leakage and short circuits, caused by water, frost and dirty streets, if the wires are under the surface, and the expense. The city of Washington, which is under trained scientific municipal management, has authorized the two-wire conduit construction for all its electric car lines.

Third, By the laying of a return wire along the lines of street pipes, and connecting it at intervals with the latter, the return wire connecting with the dynamo at the powerhouse. By this means it is proposed to lead off any current from the pipe lines. As a matter of fact investigation seems to show that it simply increases the current running through the pipes and intensifies the evil. This method, of course, is intended to be auxiliary to the use of the track as the return.

In 1894, the city of Boston, Mass.,

had a systematic expert investigation made of the electric action upon its water pipes. The lesson learned there and elsewhere, permit the following suggestions:

(1) Serious action is confined to localities where, from special conditions of electric railway construction, abnormal currents flow through the earth.

(2) On the whole, the action is now reduced to so low an amount as to be difficult to detect.

(3) Where there is serious action it can be reduced to small amount by there using special return feeders, and connection with the pipe lines by the street railway company.

(4) It is impracticable to entirely eliminate electrolysis.

(5) The danger can be reduced to a minimum by frequent inspection, locating special points of difficulty, and applying well known remedies.

(6) The action at any one point is liable to fluctuate.

(7) Even one thousandth of a volt difference in potential will set up electrolytic action.

(8) Measurements of small difference of potential between the pipes and the earth are of value in indicating direction rather than amount of flow. They are not reliable unless very carefully taken.

(9) The most practical way to reduce electrolysis in a town is to have a fully organized system of inspection and tests, thus locating points where action is occurring. Then require the railroad companies to there provide suitable return conductors, or make proper connections with pipes or rails.

(10) It would be well to divide the city into sections and at these points permanently install apparatus for measuring the flow of current between the pipes and the ground. By this means information can be obtained of the quantity of current flowing from the pipes in any particular section and a measure thus be gained of their actual rate of deterioration.

Municipal Engineering gives, after careful study, the above suggestions, but advises the person in charge of a city's interests, to be constantly on guard against electrolysis, which is so dangerous to certain of the "vitals" of every community—the many kinds of metal pipes supplying our needs.

DEPTH OF EXCAVATION BELOW GRADE OF PAVEMENT.

How deep should the excavation be below the grade of an asphalt or brick pavement?

M. J. Dill, Kane, Pa.

The total depth of these pavements varies according to the traffic it is expected to carry. Asphalt pavement for heavy traffic consists of:

Asphalt pavement surface.....	2 inches.
Binder (bituminous concrete).	1½ inches.
Concrete (hydraulic cement, etc.)	5 inches.
Total thickness.....	8½

Allowing from one-half to three-fourth inches for consolidation by the steam or other heavy roller on the graded street, according to the character of the soil, you should remove from 7¾ to 8 inches of earth below the contour lines of the finished asphalt pavement of the above thickness. A well finished and even grade prevents a waste of concrete. It is a saving to the contractor and gives the city a better pavement.

Brick pavements are best laid on concrete. An average of 31 makes of paving brick at this office, show that they vary little from four inches in depth. Therefore, provide for,

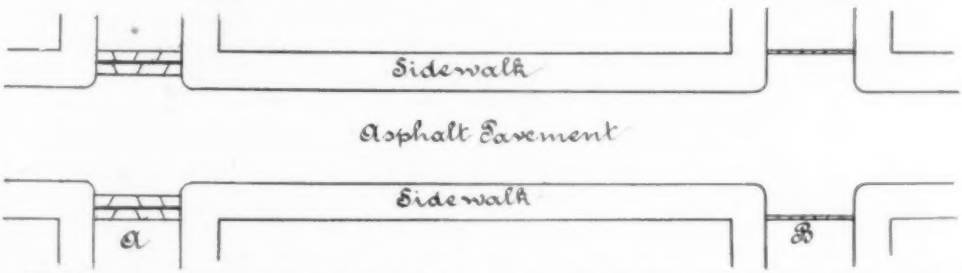
Brick	4 inches.
Sand	1 inch.
Concrete	5 or 6 inches.
Total thickness	11

Allowing as before for consolidation of the earth by a roller, you should grade to a depth of 10¼ to 10½ below the final pavement contour. Deduct an inch more where five-inch concrete is used.

STONE CROSS-WALKS ON BRICK OR ASPHALT PAVEMENTS.

Should stone cross-walks be used in connection with brick or asphalt pavements? *W. H. B.*

This is the substance of a long communication and several questions. It is, as a rule, not best to use stone cross-walks or bridgestone in connection with asphalt and brick pavements, neither across the street paved with these materials, nor across streets abutting the street. Good asphalt and good brick pavements can be crossed at any part of the street.



Walking is easier upon these than upon stone flags. Where an asphalt or brick paved street crosses one paved with another material, cross-walks should not be laid as cut A in the plan. Vertical stones as at B, about four inches thick and eighteen inches deep, called "headers," are necessary. They are set on edge with their tops flush with the pavement and back of the sidewalk and crossing line. They must not be too long, because of the cross curvature of the street; four feet each is a safe length. The arrangement at B is more economical than as at A because crossing flags cost laid about $5.40 per square yard, whereas asphalt and brick cost a little less than $3. The broadening out of smooth pavements at points of intersections as at B gives a street a handsome roomy appearance. Where an asphalt or brick pavement joins an earth or macadam roadway it is best to set the stone headers in concrete.

OLD GAS LAMP POSTS.

Our streets have old unused gas lamp posts upon them. Have they any value? *J. M. C., Pittsburg, Pa.*

Most of them should be removed and sold as old iron. Those on street corners in all parts of a city away from the center of business, can be used as convenient posts upon which to fasten special signs giving the names of streets. When thus used, and kept nicely painted, old gas lamp posts have a little value. On the whole it seems best to remove them. If gas is again used, as it may be, for street lighting, it would not be by means of the old single thin lamp posts which are useless and an eye-sore.

The position of the plugged gas pipes can be indicated by a special mark cut opposite on the perpendicular face of the curb; also by a special map, and marked positions of the gas pipes, which every city needs for many purposes.

REGULATING THE USE OF BICYCLES IN CITIES.

What is a good ordinance regulating the use of bicycles in cities?
Mayor of B——n.

This is too long to give in full. The principal points of several on file and the average requirements are: First, A bell audible 100 feet; second, a lamp visible 300 feet and lighted one hour after sunset till one hour before sunrise when bicycle is in use; third, speed less than ten miles per hour, except at street intersections and cross-walks where it shall not exceed five miles; fourth, no person older than ten years old shall ride a bicycle or velocipede on sidewalk, except invalids who are compelled to use tricycles or other self-propelled vehicles. Several cities of the United States and all cities of Europe require lighted lamps on all vehicles, carriages and wagons between certain hours of the night—a wise and just provision.

[By Charles Carroll Brown, M. Am. Soc. C. E., for MUNICIPAL ENGINEERING.]

AUTOMATIC FLUSH TANKS ON SEWERS.

Are not automatic flush tanks on sewers great wasters of water? *W. W.*

They certainly are, if the design of the tank is faulty, or if they are not properly adjusted. The water company in a certain city, where water for flushing sewers is free, sent a communication to the board of public works, stating that they believed the flush tanks in the city were using 4,000,000 gallons a day—nearly 25 per cent, of the total pumpage. A measurement was then taken by the engineering department showing that the tanks had been permitted to run without regulation and were using amounts of water varying from 234 gallons a day to 28,800 gallons a day each, the total reaching 1,800,000 gallons a day. The maximum amount considered necessary was not more than 2,000 gallons a tank, say five flushes a day, with 400 gallons for each flush, making 578,000 gallons in all, or a little over 3.0 per cent. of the total pumpage. The necessity of regulation is thus clearly shown. Tests were also made of some tanks to see what was the minimum amount of water which would properly operate the tank, and in some cases it was found that more than 2,000 gallons were necessary, while others would operate perfectly with any amount of water desired. This experiment showed the necessity of proper care in selecting the design of tank and in determining whether the individual tanks are constructed properly according to design. Flush tanks are a desirable adjunct for a sewer system for the small pipes of the upper ends and are not extravagant users of water if properly selected and adjusted.

FECAL BACTERIA IN WATER.

Can you give me some idea of what is meant by fecal bacteria, and the significance in their appearance in water?
E. B.

Bacteria are very minute rod-shaped organisms, now classed with plant life, but many of them possessing the power of motion. They are found generally in the presence of moisture on the surface of the earth, and even at some depth below the surface, under some conditions. They have been divided into numerous species, on account of the different appearances, action, and habit. Certain species are always found in discharges from the intestines of man and animals, and may be termed fecal

bacteria. These species are sometimes found in other places, but their natural home is within the bodies of animals, and their term of existence and virility in other places of abode are believed to be limited. One species is especially common in such matter, and is therefore called bacillus coli communis. This species is the one usually tested for, and its appearance is considered evidence that the water in which it appears is, or has recently been, contaminated by fecal matter. It is not yet proved that this species will not increase in numbers in surface water, under favorable conditions. Indeed, one or two investigators contend that it does so increase. The water in which this occurs must, however, be very rich in organic matter, fit food for it. Birds and animals of all sorts are sources of coli, so that the mere presence of coli in the water is not absolute proof of contaminaton by human excrement. It lays the water open to the charge, however, and demands investigation of the source of the pollution. Small numbers of coli have been found in the purest mountain streams. Large numbers of coli in the surface water indicate serious pollution, no matter what its source. In the examination of a water, therefore, it is advisable to determine not only the fact of their presence, but the numbers appearing in a given quantity of water. If fecal bacteria are found in an underground water, the source of pollution can not usually be determined, and the usual presumption is, that the water is contaminated from human fecal matter, probably leached from cesspools and vaults. See page 429 of the June number of MUNICIPAL ENGINEERING for further discussion.

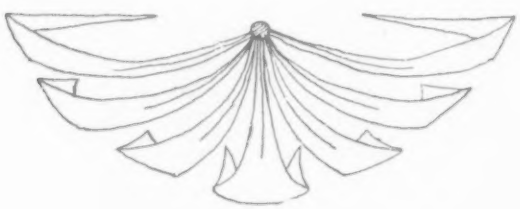
HOW TO LAY SEWER PIPE.

How should sewer pipe be laid? *R. B.*

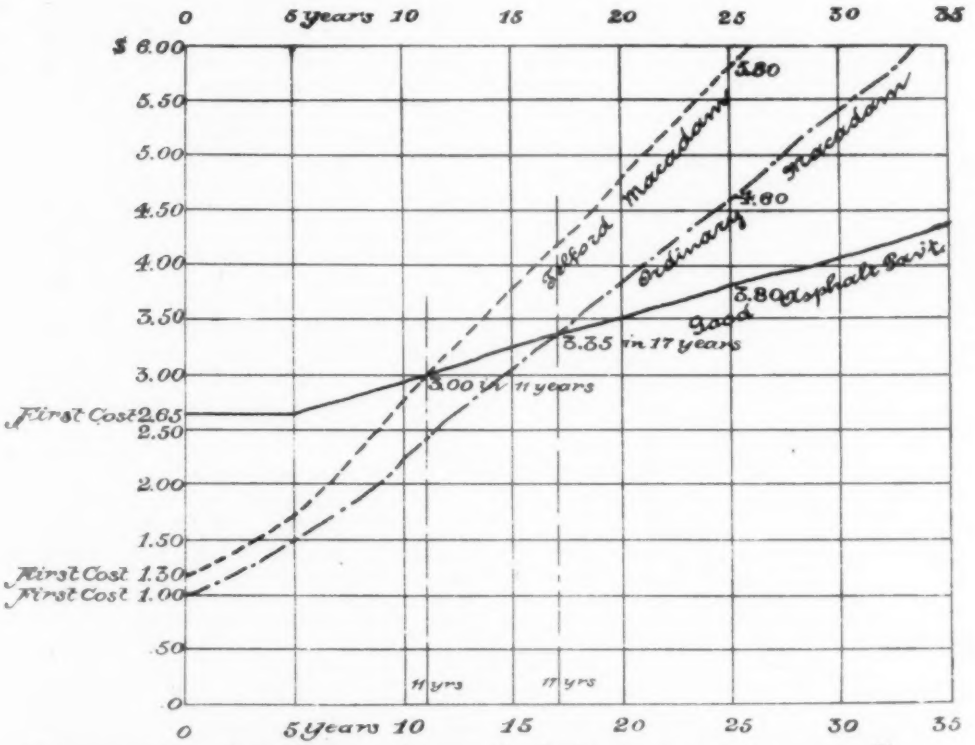
The method of laying sewer pipe varies somewhat with the character of the ground, the fall and other particulars. A common method and a very poor one is to set stakes at intervals of 25 feet or so in the bottom of the ditch and take out the bottom by eye to a gradient joining the stakes. Where the gradient is near the minimum this method is bad because it is not accurate enough to keep the flow line of the pipe straight and low spots in the grade will tend to produce deposits which may catch and hold large objects and produce stoppage. The method is also bad because the pipes rest on the bells and when the trench is filled the weight above is liable to break the pipe. Small holes should be dug with the trowel below the bottom of the trench to receive the bell, as the pipe are put in position, and the pipe thus made to rest on the ground for its entire length. An excellent method of fixing the position of the pipe, which finds favor with contractors when they have been induced to try it, is to stretch a line along the trench, usually above the surface of the ground, which shall be a fixed distance above the flow line of pipe. A pole is provided with a a piece projecting at one end at right angles. The distance of the line above the flow line is measured from the bottom of this projection along the pole and is marked. As each pipe is put in place the projection from the pole is inserted in the pipe and the mark on the pole is brought to the line by raising or lowering the necessary pipe. Care should be taken to leave the bottom of the trench too high rather than to take out too much, so that it

will never be necessary to raise the pipe any considerable amount, as the dirt put under to raise it is liable to settlement.

Before the spigot of the pipe is inserted in the bell of the pipe previously laid, mortar is put in the bottom of the bell for about one-third its circumference. When the pipe is properly placed the remainder of the joint is filled full of mortar and a bevel of about 45 degrees is formed on the outside surface. Some pipe layers can do this work quickly and well with no tool but a trowel, others require rubber mittens to press the mortar into place and properly shape the outside. Bells of pipe should be large enough and well formed to leave a good quarter of an inch all round the spigot end of the new pipe. When the ground is soft, some foundation must be put under the pipes. If this foundation is of boards, the bells of the pipe should not be rested directly on the boards, as the weight of earth on top of the pipes has been known to crush almost every pipe in a long line so laid. Concrete should be built up on the boards to the form of the pipe to give it a uniform bearing. This concrete may be of gravel and sand, five parts to one part of cement. Sometimes the soft material can be excavated a foot or so, and the trench refilled with proper material. When the ground is wet and it is especially desirable that the leakage of ground water into the pipe should be a minimum, or when the sewage must not be permitted to leak out of the joints, practically a water-tight joint can be secured by first driving into the bell of the pipe a strand of oakum which has been thoroughly soaked in a neat Portland cement mortar, and then filling the remainder of the joint in the usual manner. Care must be taken in placing the pipe in position, not to force any portion of the oakum to project into the pipe, as it may be a source of trouble from stopping matters sliding along the bottom of the sewer, and finally producing serious obstructions. Earth should be very carefully tamped under and around the pipe and for a foot or two above, so as to prevent disturbance of the joints before the cement sets, and no walking on the pipes should be permitted.



MACADAM AND ASPHALT DIAGRAM.



Comparative Cost of Macadam & Asphalt under medium traffic.

Y. W. Howard Consulting Engineer

Roadway	First Cost	Maint. for 5 yrs.	First Cost & Maint for 5 yrs	Maint. for 11 yrs	First Cost & Maint. for 11 yrs	Maint. for 17 yrs	First Cost & Maint. for 17 yrs	Maint for 25 yrs	First Cost & Maint for 25 yrs
Good Asph. Savit.	2.65	.0	2.65	.35	3.00	.70	3.35	1.15	3.80
Telford Macadam	1.30	.40	1.70	1.70	3.00	3.10	4.40	4.50	5.80
Ordinary Macadam	1.00	.50	1.50	1.45	2.45	2.35	3.35	3.65	4.65

CURRENT INFORMATION.

STREET PAVING IN NEW YORK.

Mr. Edward P. North, the water purveyor of New York, in a report which was submitted June 15 to Gen. C. H. T. Collis, commissioner of public works, reviews the year's work in the construction and maintenance of street pavements in New York in an interesting way. The following summary of work done is given:

Kind of pavement.	Square yards.	Miles.
Specification granite.....	3,643,458.15	164.01
Square granite	587,797.46	20.18
Specification trap	1,085,135.47	57.46
Belgian trap	1,467,850.64	54.92
Cobble	18,765.04	.58
Sheet asphalt	1,318,981.95	69.58
Block asphalt	7,952.00	.39
Karri wood	1,015.10	.06
Macadam	1,012,959.10	20.68
	9,143,914.91	387.56

The failure of the Eighth-ave. asphalt pavement, after the reserve for its maintenance had been expended and the company which had laid it had disappeared, caused an effort to be made to convince the commissioners that asphalt was unfit for a street of such heavy traffic. Consideration of the matter resulted, however, in the decision that the continuation of asphalt pavements on long lines of circulation was desirable. In pursuance of this policy competition has been encouraged and a vast amount of asphalt paving in the near future is recommended. The cost of asphalt pavements laid on six inches of concrete, guaranteed to be kept in good repair for five years, has averaged $2.84 per square yard, since June 30, 1895, while granite, guaranteed for six months, cost $2.87 per square yard.

Mr. North's recommendations for asphalt paving include the following streets at the estimated cost indicated: First-ave., from Houston to One Hundred and Ninth-st., repairing, $663,200; Madison-ave., from One Hundred and Twenty-fifth-st. to the Harlem bridge, $50,000; Seventh ave., from Thirteenth to Fifty-ninth-st., $380,000; Boulevard, from Ninety-second to One Hundred and Sixth-st., $64,000; tenement house district, 170 blocks on the east side of the city above Second-st., and seventy-five blocks on the west side, mostly in the densely populated districts, $2,450,000; on streets adjacent to schools and hospitals, $1,371,560.

Granite paving is recommended as follows: Second-ave., Twenty-second-st. to the Harlem river, $552,400; Sixth-ave., Carmine to Twenty-third-st., $187,200; Ninth-ave., Fourteenth to Fifty-ninth-st., $338,000.

In commenting on the proposed work Mr. North again emphasizes his policy of carrying asphalt pavements into the tenement house districts as a means of promoting public welfare, in improving sanitary conditions and in bettering the surroundings of the poorer classes. He believes it to be a helpful educational influence. He urges it for the streets adjacent to schools and hospitals as a relief from noise as well as for sanitary reasons.

Mr. North seconds the general demand for the repaving of Fifth-ave., referring to which he says: "The stones are so worn that it is one of the most dangerous thoroughfares in the city. Some of those living on that avenue wish it paved with asphalt, others prefer wood, which will be more expensive but less slippery. Wood is the pavement of luxury in Europe and England, and it is urged that the best wood pavement which can be laid is fitting to the wealth and dignity of the city of New York. The total area to be repaved, from Ninth to Fifty-ninth-st., is 62,800 square yards, which can probably be paved for between $4 and $4.50 a yard, making the approximate cost $280,000 to $283,000."

In concluding his recommendations Mr. North says that the aggregate expenditure proposed amounts to $6,500,000.

AGITATION OVER CONTRACT AWARDS AT NEW HAVEN

Rules were suspended and resolutions unanimously adopted by the board of councilman June 8 at New Haven, Conn., calling upon the street committee to request the members of the board of public works to answer such questions regarding street paving as the committee considers it important that the court of common council and the taxpayers should have

information about. This action resulted from the recent awarding of a contract by the board of public works to the Boston Asphalt Company for paving Orange, Trumbull and W. Chapel-sts. with Sicilian asphalt. The contract was awarded at a cost of $20,000 more than the price named by the lowest bidder, who proposed to use Pitch lake asphalt, and also over $20,000 in excess of the price which, it is alleged, a reliable firm offered to lay the best quality of Sicilian rock asphalt for.

A special meeting of both branches of the court of common council was called June 15 to take some action toward investigating the asphalt contract. A resolution was passed ordering the board of public works not to permit the company to proceed in the matter of laying the pavements until further orders from the court of common council are given. A resolution was also adopted defining "pavement," "paving" and "paved," wherever used in the city charter or ordinances, as including "any macadam covering known as hardening or top dressing."

REPAIR OF BRICK SEWERS.

Mr. Andrew Rosewater, in his report as city engineer of Omaha in 1895, which has just been published, refers to the importance of periodical examination of the interior of brick sewers and making timely repairs to avoid damaging breaks. He says that the wear of constant flow in the inner surface of sewers, together with the debris in storm periods, amounts to considerable in the course of from ten to fifteen years, and, in his opinion, "renders timely attention even more imperative than the repair of streets whose surface condition is constantly in view."

CALIFORNIA STATE ROCK-CRUSHING PLANT.

A formal opening of the state rock-crushing plant at Folsom, Sacramento, Cal., was held June 6 in the presence of a large body of representative citizens and many public officials. It is expected that the establishment of this plant will remove for a large section of the state the complaint of high cost of good roads, for the material can now be furnished for nearly half the state at a cost very little above that of producing it on the state's grounds. In Newark, N. J., those favoring the project of securing a steam stone crusher for the Caldwell penitentiary, cite the California state prison as an example of what can be done.

PUBLIC IMPROVEMENTS IN PITTSBURG IN EIGHT YEARS.

An outline of improvements has been presented to councils by Director Bigelow of the department of public works, Pittsburg, Pa., who says that reports compiled by the heads of bureaus under his charge show that while Pittsburg has advanced remarkably in population, the people have advanced much more rapidly in providing themselves with the comfort and luxuries which add so much to the attractiveness of a city and the pleasure of living in it.

"Except in a limited section, on the older streets," he says, "there is not a square foot of pavement in Pittsburg which has not been laid within the last eight years, either by private or public enterprise. Eight years ago the people drove through ruts and mud, under gas and gasoline lamps. Even such pavements as we had were visible only after a heavy rain. There was not a street sweeping machine in all Pittsburg. Today there is not a better paved street in America, nor a cleaner or better lighted one in the world. In the eight years since 1887, the city of Pittsburg has paved at the public expense 40.68 miles of streets, at an aggregate cost of $1,862,458.59. During the same period there have been graded, paved and curbed, under the supervision of this department, but chiefly at the voluntary expense and altogether at the instance of the owners of property thereon, 54.24 miles of streets, at a cost to them of almost double that sum, or $3,543,736.31. While the quality of the street repaving has decidedly improved, the average cost per mile has been reduced 50 per cent. in the last seven years.

"During the eight years 131.29 miles of sewers were built and laid, costing $2,123,263.19. Fourteen miles of this stand for main sewers of brick and stone. It takes $1,000 a month to keep the sewer inlets clean.

"During the same eight years the city has been obliged to lay 117.95 miles of water pipe, being not quite thirty-two miles less than was put down in all the years previous to 1888. The total length of water pipe now in service is 267.65 miles, varying in diameter from three-fourth of an inch to fifty inches, exclusive of 4.17 miles of rising mains, 3.25 of

which have been laid within the last eight years."

PROFITS OF PAVING CONTRACTORS IN KENTUCKY.

A decision was rendered by the court of appeals at Louisville, Ky., May 27, relating to original street construction. The case was Fehler and Dickson against John R. Gleason and George Gosnell, street contractors, who built a street, which Dickson and Fehler, abutting property-owners, refused to pay for on the ground that the ordinance was improperly passed. The ordinance was invalid, it was alleged, because two weeks had not elapsed between the time of its passage in each board, contending that the day on which it was passed and the Sunday intervening should not be counted; also, that the ordinance was invalid for the reason that the contractor charged for keeping the street in repair for five years. The court of appeals decided that the charge for keeping the street in repair for five years was invalid, for the reason that all such cost much be charged to the city at large. The charge for the balance of work was legal, and the point that the ordinance was improperly passed was overruled. Property-owners must, therefore, pay for the improvement, less the charge of keeping in repair for five years. A syllabus of the court of appeals is as follows:

"First—An appeal may be prosecuted from a judgment in rem to enforce a street assessment lien without regard to the amount for which the lien is adjudged.

"Second—Under the statute which provides that no ordinance for any original improvement of a street shall pass both boards of the general council at the same meeting, but that 'at least two weeks shal elapse between the passage of any such ordinance from one board to the other.' An ordinance passed by one board on Thursday and by the other board on Thursday two weeks is valid.

"Third—A provision of an ordinance for the original construction of a street which requires the contractor to keep the street in good repair for the period of five years, has the effect to require the lot-owners to pay the cost of keeping the street in repair for that period, and therefore violates the statute, which requires the cost of reconstruction or repair to be paid out of the taxes upon the city at large. But such a provision does not render the entire ordinance void, the contractor being entitled to recover except to the extent the defendant's assessment has been increased on account of the contractors undertaking to keep the street in repair for five years."

The decision will, it is claimed, allow contractors to take down the securities which they have on deposit with the city treasurer as a guarantee to keep the streets in repair for five years. The decision will have a tendency to force property-owners to settle more promptly.

WATER FILTRATION AT ST. LOUIS.

An ordinance has been introduced in the board of public improvements in St. Louis for the purchase of a water filtration plant. The capacity and character of the plant is specified in the ordinance as follows:

"The plant when completed shall have a capacity of 100,000,000 gallons in twenty-four hours. The designs for the plant shall be predicated upon the use in the settling basins of sulphate of alumina or potash alum as a coagulant, and the covering of the reservoirs in which the filtered water is stored.

"The filter plant shall be built in installments from time to time in accordance with plans to be approved by the board of public improvements."

The ordinance was introduced by L. M. Holman, commissioner of public works, who thinks that whatever experimental work is necessary should be done by the city rather than by private consumers.

NEW ENGLAND WATER WORKS ASSOCIATION.

The fifteenth annual meeting of the New England Water Works Association, held in Lynn, Mass., June 11 and 12, was attended by about 200 members. Mr. Desmond Fitzgerald, the president, in his address, called attention to the growth in membership from twenty-seven in 1882 to 529 in 1896. He hoped that an international water works convention would be held. A balance of $2,704 was reported by the treasurer, George E. Batchelder. Among the papers read before the association, some of which are reproduced elsewhere in this number of Municipal Engineering, were the following: "How to Secure Pure Water from a Surface Supply," John C. Haskell of Lynn; "The Financial Management of Water Works," Freeman C. Coffin; "The Making of Cast Iron Pipe," Jesse Garrett, Philadelphia; "Utilizing a Spring as a Source of Water Supply for a Town," Louis E. Hawes, C. E., Boston; "Method of Connecting Driven Wells to Suction Main and Connecting With Pump," F. F. Forbes, Brooooklyn; "The Relation of Light to Growth of Diatoms," George C. Whipple; "Recent Specifications for

Pumping Engines for the Water Works of St. Louis," F. W. Dean; "Water Works of Cambridge, Mass.," L. M. Hastings, city engineer of Cambridge.

Sixteen news members were admitted and officers were elected for the ensuing year as follows: President, Mr. John C. Haskell, Lynn, Mass.; secretary, Mr. J. C. Whitney, Newton, Mass.; treasurer, Mr. G. E. Batchelder, Worcester, Mass.; editors of the Journal, Messrs. Allen Hazen of Boston and W. H. Richards of New London, Conn. With the exception of the president all those named served in the same capacities last year.

The entertainment embraced a visit to Salem, Mass., on the invitation of the water board of that place; a reception and luncheon at the home of Mr. John F. Hurley, president of the Salem water board; a fish dinner at the Salem Willows; a drive through the Lynn woods and parks; an inspection of the Lynn water system and a dinner at Nahant.

WHAT A CITY ENGINEER SHOULD DO.

Mr. Andrew Rosewater's services as city engineer of Omaha distinguished him as one of the most capable and progressive municipal engineers in the country, and his record is one of disinterested devotion to the interests under his charge. An indication of the secret of his success is given in his last report, in which he says: "It has been my aim throughout the period of my service to develop some improvement each year over that of its predecessor. In concluding my public services as engineer of Omaha of the four consecutive years just closed, as of the service of twelve years previous, I do so with the conviction that whilst at times I performed services which some considered as not strictly required, I did so believing it the duty of every sworn officer to promote and protect the public interests whether personally pleasant or not. The popularity which follows inaction and passive silence in matters where public interests antagonize private or other corporate interests, is of a kind that no conscientious man can seek and at best is always short lived. A city corporation above all others is at the mercy of its trusted servants."

WATER SUPPLY IMPROVED BY SAND FILTRATION.

Since putting into operation a sand filtration plant the water company at Lambertville, N. J., is now able to give, for the fist time in its existence, a supply of water which can be used for all purposes, although the merits of the system have not yet been fully demonstrated, owing to the fact that it has not been working long enough to secure the best results. Before filtration the water contained a large amount of yellow clay in suspension and had a very disagreeable taste and odor, but the filtering process has made it clear as spring water and has very effectually removed the disagreeable taste and smell. The unfiltered water passes through an eight-inch main, where it is maintained at a depth of three feet over the sand by an automatic device; in filtering the water passes down through the various layers of sand and gravel into the 4-inch undermains. These underdraining lines, of which there are fifty in each basin, are composed of four-inch vitrified pipe, laid with open joints. The filtered water enters these underdrains at the open joints and passes into the twelve-inch conduits, which, in turn, lead to a receiving well, with which the main pipe line to town is connected. As the water is filtered only as it is used it has no chance to be contaminated by exposure to light after filtration.

FIRES ON PAVEMENTS.

The practice by children and others of lighting fires on pavements results in considerable injury. Mr. North, water purveyor of New York, says in his recent report that "no account has been kept of the damage to granite and trap pavements, but on the asphalt pavements the damage done in New York by 1,232 separate fires during 1895 has been measured. The burned area repaired amounted to 3,962 square yards, as compared with 3,410 square yards during 1894. The additional expense borne by the taxpayers on this account for the two years has been about $16,000. Through efforts of the police since November last there has been a decrease in the number of fires. In some localities this decrease has been marked, as on Henry-st., from Oliver to Rutgers-st., where the area burned was decreased from 442 to 191 square yards, and on Twenty-sixth-st., which had 433 yards burned in 1894 and 236 in 1895. On the other hand, on Willett-st., the area burned increased from 141 to 294 square yards. On Rivington-st. the increase was from 141 to 342, and on Sixteenth-st. the area burned went up from 10 square yards in 1894 to 142 in 1895."

GRADE OF ASPHALT PAVEMENTS.

A party of city officials of Oswego, N. Y., visited Syracuse and Rochester June 12 to examine pavements and, more particularly, grades. The party consisted of Superintendent F. J. O'Brien, Clerk E. A. Cooke, City Surveyor F. W. Ormsby, Messrs. McCaffrey, Clarke, Dain and Salladin of the department of works and City Clerk Wheeling.

After coming to a decision to continue the asphalt paving on W. First-st., from Bridge to Utica, the members of the department found, after examining the proposed work, that the grade would be 4.8 per cent. and they were not certain that teams could draw heavy loads up it with safety. Assured that they would find much steeper grades in both Syracuse and Rochester, and convinced that the matter was of great enough importance to the people and a principal street which might prove more of a hindrance than a benefit if not properly paved, the members of the department concluded to visit both cities and examine the grades. In Syracuse they found James-st. has a grade of 7.3 per cent., almost twice as much as that of W. First-st. James-st. is forty feet wide; the asphalt, which is put down in the center is eighteen feet in width, while the block stone borders on the sides are eleven feet in width. It is customary on streets where there is a steep grade to put in stone or brick borders so as to enable the horses drawing heavy loads to secure a firm foothold in going up a grade. From appearances, however, the stone borders do not look as if they were much used. While the committee was present several heavily-loaded coal wagons, the boxes containing two tons, went up and down the street with apparent ease. The pavement had been down seven years; the committee was askd to examine it and see how it has stood the traffic. Everything indicated that the pavement was good for several years more. The opportunity for examining it was favorable, for a portion of it was being taken up to put in water connections, and there was no perceptible wear in any of the pieces piled alongside the road, while tests made apparent the fact that the asphalt still contained life. From James-st. the committee went to East-st., where the grade is between 6 and 7 per cent. Heavy loads were drawn up and down this street with the same ease that they were on James-st.

In Rochester the committee was first taken to Spring-st., where the grade is 5 per cent., and then to Clifton-st., where the grade is 4½ per cent. The asphalt is laid the entire width of these streets and no difficulty is experienced in driving over it.

WATERING ASPHALT PAVEMENTS.

Commenting on the watering of asphalt pavements, Mr. E. P. North, water purveyor of New York, says: "An asphalt pavement affords as good a foothold as any pavement known when it is clean, but on a moist and dirty asphalt pavement a horse is in danger of a fall at any working speed. Through much of the last summer and fall many of the asphalt pavements were made dangerous by injudicious watering, and the difficulty has been greatest with thoroughfares of the most traffic. The practice has been to sprinkle the streets so copiously as to convert the dirt on the pavement into a slippery mud, but not copiously enough to make a fluid mud. The result was that it has been impossible to remove the mud either with brooms or other practical appliances. An asphalt pavement, where dirty, should have a sufficiently copious supply of water to make the result a mud fluid which can be partially removed by brooms, or entirely removed by squeegees (an amplification of the rubber blade used for cleaning windows). If the company watering the streets cannot supply sufficient water to make the mud fluid, they should be urged to so reduce the holes in their sprinklers that no mud will be formed, even at the cost of an increased number of sprinklings, or else watering the streets should be put in the hands of those who clean them."

PROFIT OF PARKS TO A CITY.

The profit of parks to a city was referred to in a recent report by J. Clyde Power, landscape engineer, recommending extensions of the park system of Indianapolis. He cites New York as a notable instance of the great increase of value accruing to land in the vicinity of parks. In 1856 the assessed valuation of the three wards adjoining Central park was $20,429,565; in 1873 it was $236,081,515, a gain in seventeen years of $215,651,950. The natural average increase of three other wards in the city, taken from all the wards, except the ones adjoining the park, showed only $53,000,000, making the earning capacity of the park $183,081,515. In Brooklyn in 1864 Prospect park—515 acres—was acquired and the increase in valuation in three years was 38 per cent.

RELATION OF TOWNS TO CORPORATIONS IN PENNSYLVANIA.

An important bearing upon the relations between boroughs and gas and water companies is brought out in a recent decision by the Pennsylvania supreme court. The gas and water company of Downington, Pa., filed a bill to restrain the borough from constructing water works. A single question was raised by the demurrer, whether the exclusive authority conferred upon the water company by the act of 1867 incorporating it was exclusive against the borough. The court decides that it is; that the borough had been empowered to supply water, but it had not exercised this power; that the borough is a mere agency for the state for governmental purposes; its charter was not a contract within the protection of the prohibition against laws impairing the obligation of contract, and it had no vested rights to its powers and franchises. The legislature had the right to take away the right of the borough to construct water works, and to confer it upon another. The boroughs' relief, the court adds, is to exercise its right to purchase the water works at a fair valuation.

RECENT PUBLICATIONS.

Country House Sewerage for Sanitation of Isolated Houses and Estates. Addresses delivered before the New York Farmers, by Col. Geo. E. Waring, Jr., and Alexander Potter, C. E., at Metropolitan Club, New York.

In the address reproduced in this pamphlet Col. Waring tells of his success in draining the sewage of the country house of Miss Mary Garrett, near Baltimore, on the surface of the ground, which proved unobjectionable and is good for the land. Sewage, as it is produced in the ordinary house, with a reasonable supply of water, is, by the Massachusetts standard, 998 parts water, one part mineral matter, and only one part in a thousand organic matter. The organic matter soils the water and by putrefaction gives it offensive character, though the putrefaction does not become offensive within two or three days, under ordinary temperature and condidtion. "If," says Col. Waring, "we can adopt a system for accumulating, say, a day's product of sewage, under conditions that will prevent putrefaction, and when that accumulation has been sufficiently large to cover a certain amount of ground, will have it delivered by some automatic flush tank, rapidly and copiously to the field where it is to be disposed of, and there allow it to flow out over the ground, and will arrange, before that ground has received too many doses, that the delivery shall be conducted to another tract, giving the first tract a little time to rest, we shall find that the whole problem which has been so annoying, so perplexing, so dangerous and so costly, is of the simplest solution and can be accomplished within a very trifling cost."

Mr. Potter agreed with Col. Waring in advocating the holding back of the coarser substances by some form of screen and after accumulating the regular flow for a day or so, to discharge its contents automatically and rapidly on the surface of the ground or immediately below the surface for final and inoffensive disposal. He advocated deviation from the commonly accepted practice, however, in the following particulars: First, substitute 1½-inch to 2-inch galvanized iron for 4-inch vitrified pipe, conveying the sewage to the disposal area; second, unless some disinfectant is introduced to render the precipitated sewage harmless, the settling tanks should be abandoned as a nuisance; third, the abandonment of the automatic flush tank as unnecessary; fourth, the adoption of a new section of agricultural porous tile for a sub-surface irrigation where absolutely necessary.

Rules and Regulations Governing House Drainage. Department of Health, City of Williamsport, Pa.

This is a small pamphlet, setting forth the Pennsylvania law authorizing boards of health to regulate house drainage, and giving in full the rules established in the city of Williamsport regulating the work of plumbers, and determining plans and specifications for house drainage and ventilation.

Michigan Engineers' Annual for 1896. Published by the Society. F. Hodgman, Secretary, Climax, Mich.

Among the papers published in the annual, which comprises 350 pages, are: "Modern Methods of Supplying Cities with Pure Water," by Allen Hazen; "Irrigation Engineering," L. G. Carpenter; "Riparian Rights," Hugo P. Geisler; "Electrolysis," Thos. P. Whittier; "Electric Street Railway Construction for Cities," R. W. Roberts, city engineer of Saginaw; "Use of the Stadia in Topographical Work," Arthur Beebe; "Use of the Plane Table," William G. Fargo; "Redemption of Shifting Sands," E. W. Muenschen; "Instructive Features and Advantages of American Bridge Practice," Edward Barrington; "Bridge Building, Past and Present," W.

J. Duncan; "Effect of Freezing Upon Cement," E. W. Muenschen; "Cement and Concrete," B. F. La Rue; "Amateur Photographing," F. Hodgman; "What Can Be Done with the Waste Products of Our Lumber Woods," J. J. Hubbell; "Artificial Preservation of Timber," Geo. L. Wells; "Special Assessments," E. Strong.

The Wisconsin Engineer. The first number of a quarterly to be issued by the University of Wisconsin, Madison, Wis. Subscription, $1.50 a year.

Catalougue of the University of Illinois for the year 1895-6. Published by the University, Champaign, Ill.

COST OF ASPHALT PAVING.

The board of public works of Kansas City, Mo., has received replies to inquiries sent out showing the minimum and maximum cost of asphalt in several cities. When but one price is given it is the average cost:

	Price per Square Yard.	
	Minimum.	Maximum.
Cleveland, O.... .....$2.85		$2.95
Peoria, Ill.... ..... 1.83		2.82
Denver 2.62		2.98
Rochester 2.50		.....
New Bedford, Mass... 2.98		3.00
Cambridge, Mass.. ... 3.00		.....
Providence 2.30		.....
Saginaw, Mich.. ..... 2.34		.....
Erie, Pa.... ..... 2.59		.....
Washington, D. C.... 1.94		2.19
Milwaukee 1.99		2.34
Atlanta, Ga..... .... 3.05		.....
Columbus, O.... ..... 2.60		.....
St. Joseph, Mo..... 2.80		.....
Grand Rapids, Mich.. 2.03		2.53

PERSONAL.

Mr. E. A. Fisher has been elected city engineer at Rochester, N. Y.

Mr. Joseph A. Latham has been elected town engineer at Cranston, R. I.

Mr. L. A. Bostwick has been appointed city engineer at Rennselaer, Ind.

Mr. E. W. Lapham has been elected street commissioner at Centralia, Ill.

Mr. Everett S. Locke has been elected water commisssioner at Lexington, Mass.

Mr. George R. Hall has been appointed street commissioner at West Duluth, Minn.

Mr. James Crosson, ex-street commissioner, Washington, Ind., died in that city June 18.

Mr. Charles Hahn has been appointed superintendent of the water works at Ottawa, Ill.

Mr. Peter Weida, C. E., Allentown, Pa., died in that city June 7, aged seventy-seven.

Mr. Patrick W. Halpin, Waterbury, Conn., has been elected superintendent of water works.

Mr. Frank G. Schirmer has been appointed water commissioner at White Plains, N. Y.

Mr. W. W. Glore has been re-elected superintendent of the water works board at Covington, Ky.

Mr. Patrick W. Halpin, superintendent of water works at Waterbury, Conn., has resigned his position.

Mr. Frank Bergen has been elected president of the Plainfield water company, Plainfield, N. J.

Mr. William Mannering has been appointed a commissioner of the water works at Newport, Ky.

Mr. John M. Campbell of the contracting firm of Campbell Bros., Altoona, Pa., died June 15, aged seventy.

Mr. Charles C. Bigelow has been elected president of the board of water commissioners at Mt. Vernon, N. Y.

Mr. James Morrow, Wellsville, N. Y., has been appointed superintendent of water works at East St. Louis, Ill.

Mr. R. S. Clark has been appointed water commissioner, to succeed Mr. Bartholomew Mulcahy, at Cohoes, N. Y.

Mr. William Belcher and Mr. Samuel T. Adams have been re-elected sewer commissioners for two years at New London, Conn.

Mr. Henry C. Ilson, Whitehall, N. Y., has been appointed an inspector in the department of public works at Albany, N. Y.

Mr. S. B. Thimens has been appointed superintendent of water works at Fargo, N. D., to succeed Mr. S. W. Kelly, who resigned.

Mr. Charles M. Dorr, Mr. Frank P. Reeve and Mr. Nathan Wimpfheimer have been elected water commissioners at Somersworth, N. H.

Mr. William K. Dunbar, Pittsburg, Pa., has been appointed superintendent of the Wellsville Water and Electric Light Co. at Wellsville, N. Y.

Mr. A. W. Campbell, C. E., has been appointed Provisional Instructor in Road-Making at Toronto, Ontario. Mr. Campbell's office is in the new parliament buildings.

Mr. Irving E. Matthews has been appointed assistant engineer of the West Side sewer commission to succeed Mr. George Green, who resigned, at Rochester, N. Y.

Col. George Waring, of New York City, delivered the annual address this year before the Yale Medical School, New Haven, Conn., which related to the "Proper Disposal of Sewage."

Mr. H. Somers Hayes, New York City, has been appointed a commissioner on the selection of a site for the New York and New Jersey bridge. Mr. Hayes succeeds the late Col. F. K. Hain.

Mr. O. W. Pfouts, for more than five years assistant city engineer at Canton, O., has been appointed city engineer at Alliance, O., for a term of two years to succeed Mr. George R. Gyger.

Mr. George M. Walker, jr., city engineer at Argentine, Kas., has resigned his position and accepted that of assistant engineer and roadmaster of the Kansas City Belt railway company. Mr. Walker will serve in the capacity of acting city engineer, however, until a successor is appointed.

G. M. La Noue, city engineer at Houston, Tex., died June 2. Mr. La Noue was elected last April for a term of two years. Mr. Louis A. Guerniger, who has served as assistant city engineer for some time, has been elected to succeed Mr. La Noue, and Mr. William Bradburn has been appointed assistant city engineer.

The New York board of trade and transportation has adopted resolutions commending the present management by Col. George E. Waring of the street cleaning department of New York. The resolution adds: "For the first time in its history the poorer portions of the city are cleaned as thoroughly as the richer portions, and its citizens can claim that New York is one of the cleanest of the great cities of the world. This is especially gratifying as illustrating that business methods can be attained in the management of public business under a republican form of government."

Col. George E. Waring, jr., commissioner of street cleaning, New York City, contemplates making a bicycle tour of Germany, France and Switzerland during the summer. During Col. Waring's absence Capt. Gibson, deputy commissioner, will have charge of the department.

Governor Morton of New York has appointed the commission to prepare a charter for the consolidated cities and towns commonly known as "the Greater New York," as follow: New York City, Seth Low, president of Columbia college and ex-mayor of Brooklyn; Benjamin F. Tracy, ex-judge of the court of appeals and ex-secretary of the navy; John F. Dillon, ex-judge of the United States circuit court; Ashbrook T. Fitch, comptroller of the city of New York and ex-member of congress. Brooklyn, Stuart L. Woodford, ex-lieutenant-governor; Cyrus B. Dutcher, ex-superintendent of public works; William C. DeWitt, ex-corporation counsel. Richmond county (Staten Island), George N. Finney, jr., district attorney. Queens county, Garret J. Garretson, county judge. The other members named are: Andrew H. Green, president of the old commission; Campbell W. Adams, state engineer; Theodore E. Hancock, attorney-general; William L. Strong, mayor of New York City; Frederick W .Worster, mayor of Brooklyn; Patrick J. Gleason, mayor of Long Island City.

MUNICIPAL REPORTS.

PHILADELPHIA, PA.—Thomas M. Thompson, director of the department of public works, in his annual report dwelt particularly on the importance of street cleaning and the satisfactory work of the bureau in charge of this work in 1895. The cleaning embraced 88,166 miles of streets, at an aggregate cost of $765,790.28, including the removal of 235,866 loads of dirt, 620,055 loads of ashes and 135,513 loads of kitchen garbage. Fines were imposed on contractors for neglect amounting to $17,414.

Referring to the removal and disposal of garbage as a perplexing problem, Mr. Thompson says the cremation process is open to the criticism of wastefulness and imperfect combustion at times. The reduction system commends itself because of its sanitary features; yet this method does not dispose of all the waste of a city; and he believes in the near future the larger cities will be compelled to operate a crematory in connection with the reduction system, in order to dispose of such matter as cannot be utilized. The plants in operation in Philadelphia at present for the disposal of garbage, are: Reduction, by the "Arnold System Improved," operated by the American incinerating company; and incineration, by the "Smith-Siemens Furnace," two plants, operated by the Philadelphia incinerating company. The aggregate amount of the contracts for 1896 is $781,918.00, which is $26,127.00 in excess of the contracts for 1895. There are two reasons for this increase; (1) the growth of the city; (2) the demand of the public for better service. The director thinks that if contracts were awarded for a period of three years cheaper and better work could be obtained

Thomas L. Hicks, chief of the bureau of highways, reports the expenditure of $1,422,658.19 during 1895, and a balance of $708,982.96 brought forward for 1896. Less work was done than in the previous year. The new paving embraced: Granite blocks, 90,090 square yards; sheet asphalt, 110,342; vitrified brick, 131,051; asphalt block, 1,309; macadamizing, 146,024; total, 478,816. Cobblestones were replaced with improved pavements as follows: Granite,

2,977 square yards; asphalt, 2,834; brick, 6,901; granolithic, 15,722; slag block, 1,812; total, 30,246.

Mr. Hicks strongly urges the continuation of granite curved curbing in place of square corners. He points out various faults in the present paving specifications. For example, one ordinance requires four inches of concrete for brick wearing surface and another requires six inches for granite block; the bearing of the brick being twenty square inches, while the granite block will average 44 square inches.

In one set of specifications it is required that natural cement shall develop an initial set in not less than ten minutes and hard set in less than thirty minutes; Portland cement shall require at least thirty minutes to develop initial set and the use of any concrete which has been mixed more than half an hour is forbidden. Two other forms permit the use of concrete which has been mixed more than three hours.

Mr. Hicks recommends requiring a guarantee of from ten to fifteen years on all pavements.

CHICOPEE, MASS.—The municipal register for 1895 comprises official reports and statistics making over 200 pages, including the first annual report of the city engineer, Frank P. Cobb. The principal municipal work during the year was the construction of a few bridges and the extension of sewers.

FORT WAYNE, IND.—The chief feature of the volume of 300 pages containing the annual official report for 1895 is the Board of Public Works' account of its experiments with garbage crematories, the essential points of which were given in the January number of Muncipal Engineering.

LA CROSSE, WIS.—The annual report for 1895 sets forth the details of affairs in the different departments of the city government, but no important or notable improvement work is noted, other than the recent addition of a new 10,000,000 gallon pump to the water works system. Mayor Powell makes the claim that the water works of La Crosse are the most complete of any city of equal size in the country. La Crosse has no paved street. The mayor urges the use of vitrified brick as best suited to the town.

RUTLAND, VT.—The third annual report of Rutland shows much care in its preparation. City Engineer Sidney Smith, in connection with his report on the construction of sewers, describes the separate and combined systems, and explains in detail the local work. About 26,000 square yards of macadam pavement was laid in 1895. At the suggestion of the city engineer a rule has been established requiring the laying of old water pipes on the north and east sides of streets at a distance from the street line equal to one-third the width of the street. This is done in order that the location of water pipes may be known with certainty without reference to maps.

LETTERS FOR THE PUBLIC.

HEALTHY WATER FOR EVERY HOUSE.

To the Editor of Municipal Engineering:

No one will question the great need and desirability of a cheap and constant supply of pure water. There are few cities that can boast of this great luxury and health preserver. Nearly all cities are supplied by the "water sheds" that form creeks or rivers. These streams not only get the "wash" of all the lands adjacent, but also the drainage of all the towns on these streams. How is it possible to have pure, healthy water from such sources? The only possible way is by distillation, and that is too expensive for common use. Now the rainfall throughout the United States (with the exception of a few localities) is sufficient to supply all the people with pure water, not only for drinking and cooking, but in most cases for washing clothes.

I am not talking from hearsay, but from actual experience and practice as a builder in several places in Mississippi and Louisiana. How did I do it? Well, it is the simplest kind of a thing if you know how to do good brick and cement work. I just build cisterns, sometimes over ground, where the land is very salt, but most places underground, where the ground can be dug out ten to twelve feet deep.

If a surface cistern be most desirable, build a four-sided cistern, with the sides slightly curved inward. The corners will be built so as to form solid buttresses, to prevent outward thrust by pressure of water. This cistern is built of hard brick, wet, and of good cement mortar. The walls are 9 inches thick, with a broad

"footing" for foundation, at least 30 inches wide. The bottom of the cistern must have at least three courses f brick, must have at least three courses of brick, well laid in cement, the brick laid flat, with full flushed joints. This cistern may be built any size and if not over 16 feet square can be easily arched over. Sixteen feet is a good height to build them. When well built and cemented, they are as tight as a tug and will last forever where there is no heavy frost.

Where there is much freezing the underground cistern is best. They are used extensively in Louisiana and Mississippi. Every well provided homestead has at least two cisterns. One is filled by the winter rain and then closed, so that no more water falls in it until the next winter. The water becomes perfectly pure and transparent within three or four weeks after the cistern is filled. The temperature is about 60 degrees Fahrenheit in summer. This cistern supplies a large family with water for drinking and cooking.

For washing and other purposes at least one other cistern is built, into which all rains fall and the supply never fails. The cisterns are from ten to fourteen feet deep, and from ten to twelve feet in diameter "clear." The bottom and top are arched. The walls are best 9 inches thick, but I have built many with only half that thickness, excepting the "crown," which should be one brick length thick. An expert cistern builder can put on the crown arch as well, or better, without a "center" than with it.

These cisterns can be successfully built in all northern cities. There is always room enough in back yards for two cisterns. The crowns would have manholes and pipe for pumps could be put anywhere desired. The cost of these cisterns is from $80 to $160, which is a mere trifle compared with the real value and great benefit to all concerned. J. W. CRARY, SR.

Bluff Springs, Fla.

COST OF THE ENGINEERING OF PUBLIC WORK.

To the Editor of Municipal Engineering:

I notice in your April number a table prepared by Mr. A. D. Thompson, city engineer of Peoria, Ill., giving the cost of the engineering part of public works in a number of cities. This is a question in which I am interested just now and wish to obtain more information. Is it asking too much to request that this subject be enlarged upon through your columns by the engineers of other cities, and make the information more explicit by stating the character of work, cost of each class, cost of inspection, as well as engineering, and where there has been extraordinay work, such as an entire new system of sewers, water works or an extended system of city improvements, requiring the high-priced services of engineer specialists, either for designing systems or as consulting engineers, or in both capacities, give the cost of such special service separate from that of the ordinary work. I would like particularly to know the reason for the high cost of work at Duluth, Memphis and Salt Lake City. I think such information would be of interest to many of your readers. I am a new subscriber to your magazine and am much pleased with it. I make a specialty of work in cement and concrete and have already found useful information in your pages.

CIVIL ENGINEER.

San Antonio, Tex.

BERMUDEZ SHEET ASPHALT IN CHICAGO.

To the Editor of Municipal Engineering:

We notice in your issue of June of this year a report upon the pavements laid in different cities in the United States and Canada up to Jan. 1, 1896, and note with some surprise that the city of Chicago is not credited with any Bermudez sheet asphalt. Why this so we cannot understand, but as this company has already laid over five miles of Bermudez we desire a correction made in the report.

BERMUDEZ ASPHALT CO.,
By JOHN P. AGNEW, Sec'y.

Chicago, June 6.

(Much difficulty was experienced in obtaining the satistical information given in the table referred to in the form set forth specifying different kinds of materials; especially was this true of Chicago, though that is not a sufficient excuse for the omission referred to above, as it is well known that a considerable proportion of the recent asphalt paving in Chicago has been laid with Bermudez asphalt. The difficulty encountered in gathering the statistics compiled in the table referred to was in showing the extent of use of different materials; so many of the city officials followed the usual practice of reporting so much asphalt, brick, macadam, etc., without specifying which kind of asphalt, that the exact information had to be obtained through a second or third effort, and in a

few instances by special measurement by our representatives. We mention this to show not only the difficulty of getting such information in the desired form, but also for the purpose of stimulating appreciation of the importance of furnishing it on the part of city officials, who are, we are gratified to say, however, very courteous, as a rule, in responding to communications from this magazine.)

MACHINERY AND TRADE.

CONTRACTOR'S DUMP WAGON.

The Contractor's Dump Wagon recently put on the market by the F. C. Austin Mfg. Co. of Chicago is something contractors will appreciate. A serious difficulty with all "bottom dump" dump wagons previously constructed has been that the doors being hinged and, therefore, laterally rigid, frequently stall the team on the dump. When it is understood that all dumps, whether of earth, rock or garbage, are very uneven and that one or more of the wheels, when the load is being dumped, rests in a pocket or low place, the objection to the hinge doors will be apparent; for example, should the hinge door strike a load previously dumped, or any obstruction before the load is fully discharged, it is necessary to move in some other direction to release the door, which, as will be understood, cannot be done without heavy pulling and a strain on the team; again, with one of the front wheels in a low place, the front end of the hinge door is likely to run into a previously dumped load or obstruction, which stops the team, as well as wrenches the box, tearing off the hinge door. The doors of the Contractor's Dump Wagon, when closed, make a comparatively tight bottom; when open they can oscillate in any direction, thereby adjusting themselves to the debris or obstruction underneath.

TRADE NOTES.

The Crystal Glen Stone Crushing Co., Warsaw, Ill., has closed down.

Somerville, Mass., contemplates the purchase of a new stone crusher.

The purchase of a steam road roller is contemplated at Clarksville, Tenn.

J. K. Caldwell, Minneapolis, Minn., is organizing a stock company to manufacture paving brick.

The Shepherd Sewerage System Company, 61 Beekman Street, New York City, has gone into the hands of a receiver.

The De Pere Terre Cotta Co., De Pere Wis., has begun operations. Brick and sidewalk tiles are being manufactured.

The Park Commissioners, Prividence, R. I., were authorized June 8 to purchase a steam road roller at a trial, not to exceed $3,000.

The Carson Trench Co., Boston, Mass., will ship seven trench machines to the City of Mexico for use in the construction of a new sewerage system.

A sub-committee, consisting of Aldermen Fish and Nichols was appointed recently at Taunton, Mass., to consider the advisability of purchasing a portable stone crusher.

The sewer pipe and flue lining department of the C. Pardee Works has closed down for an indefinite time, owing to the strong competition and low prices that have prevailed for the last few months.

It is reported that a proposition is under consideration for shipping California asphalt to France, the higher grade of which, it is believed, will more than compensate for the greater cost of transportation.

The Newark Paving Co. has been incorporated at Newark, N. J., by Thomas Harlan, Owen A. Cahill and Mary L. Conway. The company will engage in street paving, sewer construction, etc., in Essex and Hudson counties.

W. L. Wall, Moline, Ill., has purchased the stock of Milo Lee in the Argillo Brick and Tile Works, at Carbon Cliff, Ill. Among the new features to be added to the making of tile, sewer pipe, fire brick, etc., will be the manufacture of sidewalk tiles.

The Eclipse Paving Co., Hubbard, O., has passed into the hands of Receiver Frank Doughton. Several suits instituted against the company and a mortgage of $5,000 on the plant precipitated the suit. The works will continue under Mr. Doughton's management.

York, Pa.—The purchase of a steam road roller is being agitated. Chas. C. Burgesser.

Pine Island, Minn.—The city council has ordered the purchase of a road machine. M. E. Billings, Recorder.

Passaic, N. J.—The purchase of a new watering cart, not to cost more than $350, has been authorized. Street Commissioner.

La Salle, Ill.—Bids will be received until July 7 for furnishing a ten to fifteen-ton steam road roller. F. W. Matthiessen, Mayor.

The bill introduced in the New York legislature proposing to prohibit the use of imported materials in the paving of streets in New York failed, having been withdrawn from before the legislature by the committee which reported it.

Stockton, Cal.—Bids will be received until July 13 for a fifteen-ton steam road roller for which an appropriation of $4,000 has been made; the board of supervisors will also ask for bids for two sprinkling wagons of 1,000 and 600 gallons, respectively.

The International Land and Material Co. has been organized at Norfolk, Va., to deal in fire brick and moulders' sand and material. The officers of the company are: President, George M. Meredith; vice-president, Cassius M. Inman; secretary and treasurer, George P. Hudson.

The Syracuse improvement company, Syracuse, N. Y., has obtained control of the stock of the Bermudez paving company of that city. The transaction was brought about by the purchase of Hendrick S. Holden's and John H. Drake's stock in the company by W. H. Gallup and Charles Warner of the improvement company.

A brick manufacturing plant has been established at Pittsburg, Pa., by Benney & Co. This firm secured a contract some time since for building a sewer in the Four Mile run, which would require 2,000,000 brick. For a time the company was at a loss to know where to secure the brick, but finally decided to build a plant and manufacture the brick needed in the construction. Now that the plant has been established it will be made a permanent enterprise.

Bids were received June 8, at East Orange, N. J., for a twelve-ton steam road roller, as follows: Julian Scholl & Co., New York, $3,300; W. Churchill Oastler, New York, $2,800; Pitts agricultural works, Buffalo, $3,250; W. R. Fleming & Co., New York, $3,250; the Aultman company, Canton, O., $3,250. The bids were referred to the road committee.

In a recent article describing the work of the improved Carson trench machine, the Lowell (Mass.) Times says of it: "It is one of the many devices which have made possible the marvelous engineering feats for which this country is famous, and if it is opposed because it throws a few men out of employment it may be said that the same objection has come up whenever any new machine has been introduced. Yet who can doubt the benefit that this country has derived from the innumerable machines now a part of our daily life or doubt that the enormously increased benefits received by us in these latter days of the nineteenth century are due, in a great measure, directly to machinery? If it costs less to build sewers it is very easy to see that more miles of sewers can be built with the same appropriation, and that this will be the natural result of introducing the sewer machine."

Mr. L. W. Post, vice-president and general manager of the Blackmer-Post pipe company, St. Louis, writes to Municipal Engineering: "It may be of interest to you to know that we are having quite an active demand for large-sized sewer pipe. The large amount of work we have done in the way of advertising and personal solicitation is now bearing fruit, and last week we booked an order from the city of Cedar Rapids, Ia., for 2,700 feet of thirty-inch Standard culvert pipe, and today have closed a contract to furnish the city of Waterloo, Ia., 3,200 feet of the same size. Besides this, we are negotiating with other parties, who will require several thousand feet more. We are having some inquiry also for thirty-six-inch pipe, with good prospects of early sales. There is little doubt now in our minds that at the prices at which we are enabled to put large sizes of vitrified pipe on the market they will soon be used almost exclusively in place of brick sewers of relatively the same capacity."

IMPROVEMENT AND CONTRACTING NEWS

PAVING.

Newark, N. J.—The paving of Halsey-st. with asphalt will give a good route for bicyclists north and south through the city free from electric cars and heavy traffic wagons.

Jacksonville, Fla.—The total number of blocks of brick paving completed in this city is ninety-four and there are outstanding contracts for a large amount more of it.

Hoboken, N. J.—The certiorai proceedings instituted by the Barber Asphalt Paving Company to set aside contracts awarded by the Hoboken city council to Henry & McGibney and other contractors for paving streets in this city with asphalt have been decided in favor of the city, sustaining the council.

Lancaster, Pa.—At a special meeting of the street committee of councils recently, to decide whether or not the names of the paving blocks to be used should appear in the specifications, the motion of Mr. Dinans was adopted, providing that the Hallwood, Royal Canton and Mack blocks will be specified in the contract for paving and that bids will be accepted for other kinds, provided the blocks are not of inferior quality.

Philadelphia, Pa.—The Citizens' Municipal Association has called the attention of Director of Public Works Thompson to the condition of the unpaved streets and roads in the outlaying sections of the city, which is reported as bad. A thorough inspection of the streets and roads revealed the fact that, with few exceptions, no attempt has been made to comply with the requirements of the contracts. While the roads have been scraped, yet the parties supervising the work do not, apparently, understand the requirements of the contract and specifications. Section 2 of the specifications, which requires that the road surface shall be repaired and maintained by supplying the material required, doing all the work required to make a smooth highway, has not been complied with in any way. Section 3, which states that "the macadam roads shall have a central cartway maintained of not less than 18 feet in width, that ruts and holes and depressions shall be thoroughly filled with stone not inferior to the best trap rock, covered with screenings and rolled with a steam road roller weighing not less than five gross tons, and when completed to have a fall from the center of the road to the gutters of not less than one-half inch per foot, to insure proper drainage," has been lost sight of also. The inspection showed that in many cases the shoulders between the center of the street and the gutters are from 15 to 18 inches higher than the center of the road, so that it was impossible for the water to drain from the center to the gutters. The communication says that "if the macadam roads were repaired by these specifications they would be equal to the best park drives."

CONTEMPLATED WORK.

Newburyport, Mass.—Storey avenue will be macadamized.

Lincoln, Ill.—Paving is being considered for Tremont street.

Madison, O.—A resolution has passed to macadamize Lake street.

Clinton, Ia.—The paving of Comanche avenue is contemplated.

Atlanta, Ga.—Elizabeth street will be paved at a cost of $9,300.

Joplin, Mo.—Third street and Grand avenue will be graded and graveled.

Stockton, N. J.—The question of macadamizing the streets is being agitated.

Glenridge, N. J.—Street improvements to the amount of $60,000 are contemplated.

Worcester, Mass.—About $35,000 will be expended in paving and sewer construction.

Lowell, Mass.—Asphalt paving is almost unanimously favored for Westford street.

Scranton, Pa.—West Lackawanna avenue hill will probably be paved with stone blocks.

Davenport, Ia.—Paving is contemplated for eleven additional blocks of streets.

Cortland, N. Y.—Railroad street, from Main street to the D., L. & W. Railroad, will be paved.

Miamisburg, O.—Main street will be paved with asphalt, asphalt block, brick or block.

Attica, Ind.—Concrete walks are proposed on Pike street, between Brady and College streets.

Canton, Ill.—The city council has passed ordinances for more than one mile of brick pavement.

Iowa City, Ia.—The city council has passed the extension of the brick paving on Clinton street.

Tampa, Fla.—The Board of Public Works has decided to let the proposed paving out by contract.

New Castle, Pa.—Ordinances have been passed for paving with brick Walnut street and Terrace avenue.

Elmira, N. Y.—Plans have been ordered prepared for extending the asphalt paving in West Church street.

Lawrenceville, Ill.—A new granitoid walk, 8 feet wide, is contemplated around the Court House square.

Sea Cliff (L. I.), N. Y.—The question of bonding for better streets and sidewalks was voted on June 27.

Evanston, Ill.—The residents of Harrison street favor an asphalt pavement on a 6-inch concrete base and stone curbing.

Arcadia, Minn.—The sidewalks of the entire business section of the town will be paved with limestone or Portland cement.

Pawtucket, R. I.—The aldermen are urged to pave Cottage avenue with asphalt by the residents of that thoroughfare.

Athens, Ga.—Belgian block paving is contemplated for the streets in the business portion and those leading to the depot.

Detroit, Mich.—Virginia avenue, from Second to Third avenue, will be curbed and paved with brick on concrete foundation.

New Britain, Conn.—The appointment of a committee to consider permanent paving for Main and Church streets is proposed.

New York, N. Y.—Alexander avenue will be paved with asphalt from the Southern boulevard to One-hundred and Forty-third street.

Winnipeg, Man.—The council has voted to pave four streets with asphalt and two with cedar blocks. C. J. Brown, City Clerk.

Chicago, Ill.—A delegation called on Mayor Swift June 26 to protest against the proposed asphalt paving on West Madison street.

Morristown, N. Y.—Asphaltic paving is contemplated for the north and west sides of Park Place and on one block of Washington street.

Far Rockaway, N. Y.—An issue of $200,000 in bonds is contemplated which will be expended in paving, building highways, constructing sewers, etc.

Meridian, Miss.—The street committee is investigating paving in different cities. About $100,000 will be expended for that purpose in this city.

Los Angeles, Cal.—Cement sidewalks and cement curbings have been ordered in Towne and Stanford avenues, under the bond provisions of the Vrooman act.

Providence, R. I.—The abutting property-owners on Cottage street have asked that asphalt paving be laid between Central avenue and Summit street.

St. Paul, Minn.—The final order for paving E. Fifth street with asphalt, from Cedar to Broadway, and with brick, from Wabasha to Cedar, passed June 16.

Pawtucket, R. I.—Ordinances have been passed making appropriations for the improvement of Central, Fairlawn and Francis avenues and Perry, Trenton and Carpenter streets.

Jackson, Mich.—Brick paving is contemplated for Pearl street, from Jackson street to the bridge. Sections of several other streets are also in need of paving.

Syracuse, N. Y.—A petition has been presented to the common council asking that Irving street, from Water to Harrison, be paved with asphalt, asphaltina, brick or sandstone.

Indianapolis, Ind.—Walnut street, from Capitol avenue to Senate avenue, Delaware street, from Fourteenth to Fifteenth street, and the first alley east of Pennsylvania street, from Massachusetts avenue to New York street, will be paved with asphalt. Cement sidewalks will be built in East street, from Massachusetts avenue to St. Clair street.

Williamsport, Pa.—Market street, from Fourth street to the Philadelphia & Reading Railroad, will be paved. The ordinance provides also for crossings of brick, stone and wood.

Denver, Col.—At a meeting of the supervisors, June 13, two new ordinances were introduced providing for the paving of lower Fifteenth and Broadway streets, from Welton to Colfax.

Morristown, N. J.—Under the supervision of City Engineer Howell, macadam roads will be constructed from Spuchwell avenue to Washington street, and on Washington street, from the Court House to South street.

Buffalo, N. Y.—Sweet avenue, from Sycamore street to Walden avenue, will be paved with Trinidad asphalt. The citizens of Black Rock have also voted to repave Niagara street, from Bird to Hertel avenues with asphalt.

Jersey City, N. J.—A petition has been filed for an asphalt pavement in Danforth avenue. There is considerable opposition owing to the fact that the street is already paved with Belgian block.

Rock Island, Ill.—(Special.)—W. A. Darling, City Engineer, says that four and one-half blocks of brick paving on a macadam foundation and about 500 feet of stone paving is contemplated. Anamosa or Kettle River stone will be used.

CONTRACTS TO BE LET.

Trenton, N. J.—Bids will be received until July 7 for paving Mead street with brick. C. Edward Murray, City Clerk.

Fort Wayne, Ind.—Bids will be opened July 10 for paving W. Jefferson street, from Broadway to Garden, with brick.

Superior, Wis.—Press reports are to the effect that bids are asked until July 15 for paving Grand avenue.

East Berlin, Conn.—Bids are invited until July 6 for building a macadam road. N. F. Taylor, Selectman.

Buffalo, N. Y.—Bids are invited until July 8 for paving with asphalt portions of four streets. R. G. Parsons, Director Public Works.

Washington, D. C.—Sealed proposals will be received until July 6 for furnishing granite curbing. John W. Ross, Commissioner.

Bloomington, Ind.—Bids will be received until July 9 for repairing Stephens, Dinsmore and High Pikes. J. M. Hinkle, County Auditor.

Huntingburgh, Ind.—Sealed proposals will be received until July 20 for grading sundry streets. Deposit, $10. Jac. Murray, City Clerk.

New York, N. Y.—Sealed proposals are invited until July 7 for furnishing 10,000 cubic yards of screened gravel for roads Park Department.

Chicago, Ill.—Sealed proposals will be received until July 7 for improving sundry streets and alleys. Certified check, $1,000.

Cleveland, O.—Sealed proposals will be received until July 22 for grading, draining, curbing and paving with asphalt, Giddings and Murray Hill avenues. Certified check, $2,000 each. Also paving with brick and old Medina stone redressed, Eastman street. Certified check, $1,000. D. E. Wright, Director of Public Works.

Port Clinton, O.—Sealed proposals will be received until July 11 for curbing and paving with brick Third street. Bond, $500. A. N. Harms.

Indianapolis, Ind.—Sealed proposals will be received until July 6 for grading and graveling New York street, from Miley to Lafayette avenues, from Lynn street to Miley avenue, and from Belmont to Lynn street; also, for grading and graveling sundry alleys and for cement walks in Meridian street from the railroad tracks to Raymond street.

Warren, O.—(Special.)—Sealed proposals will be received until July 14 for furnishing vitrified paving brick for the following streets: Washington avenue, 7,531 square yards; Monroe street, 4,539 square yards; certified check, $500. Proposals will be received until July 15 for constructing the above work. Certified check, $500. Albert E. Andrews, City Clerk. For further information apply to Homer C. White, City Civil Engineer.

Fort Dodge, Ia.—(Special.)—Sealed proposals will be received until 6 o'clock p. m., July 20, for furnishing all material and paving Central avenue, from Third to Twelfth streets, with paving brick, on sand and gravel, or broken stone; also, stone curbing where it is decided necessary. All bids must be accompanied by a certified test, from good authority, of the brick to be used, including three samples of brick to be used in under course, and ten samples of brick to be used in top course. Certified check for at least ten per cent. of the amount bid. D. A. Miller, City Clerk.

St. Louis, Mo.—Sealed proposals will be received until July 7 for grading a large number of alleys and for granite curbing and vitrified brick paving in sundry alleys. Robert E. McMath. President B. P. I.

St. Paul, Minn.—Sealed proposals will be received until July 2 for paving with asphalt Summit avenue, from Dayton avenue to Sixth street. Certified check 10 per cent. John C. Mueller, Clerk B. P. W.

Terre Haute, Ind.—Sealed proposals will be received until July 7 for paving with brick College and Tippecanoe streets and sundry alleys. Certified check, $200 each. Chas. H. Goodwin, City Clerk.

Sandusky, O.—Sealed proposals will be received until July 2 for paving Market street, from Jackson to Pearl, with brick. Certified check, $1,000. A. W. Miller, City Clerk.

Gas City, Ind.—(Special.)—Sealed proposals will be received until July 19 for improving 2,800 feet of streets by grading and graveling roadway, plank curb and paving sidewalks with brick. W. J. Kyle, City Clerk.

Alexandria, Ind.—Bids are asked until July 11 for 4,318 lineal feet of brick paving. Bids will soon be asked for 12,000 square yards of brick roadway and 3,800 square yards of brick sidewalks. G. A. Gessner, City Engineer.

Auburn, N. Y.—Sealed proposals will be received until July 10 for brick paving in that portion of State street, between the terminus of the present paving and the north rail of the N. Y. C. & H. R. R. Co.'s tracks. F. B. Ives, City Clerk.

Chicago, Ill.—Proposals will be received until July 13 for furnishing and delivering 5,500 cubic yards of crushed limestone on Grand boulevard, between Oakwood boulevard and Fifty-first street. Certified check, $100. E. G. Shumway, Secretary South Park Commissioners.

Toledo, O.—Sealed proposals will be received until July 6 for paving Sixth street, from Main to Nevada, with brick or blocks, together with the necessary grading, curbing, drainage, etc. Certified check, $350. Lem P. Harris, City Clerk.

Greenfield, Ind.—Sealed proposals will be received until July 15 for paving with cement the sidewalk on the north side of South street. Certified check, $100. Also, for grading and graveling the roadway and paving with cement the sidewalks on Main street. Certified check, $100. Wm. R. McKown, Clerk.

Defiance, O.—Sealed proposals will be received until July 21 for improving Holgate avenue and Third street. J. J. Malley, City Clerk.

Galesburg, Ill.—(Special.)—Sealed proposals will be received until July 20 for paving Cherry and North streets with brick. M. J. Blanding, City Engineer.

Flushing, N. Y.—Bids will be received until July 9 for macadamizing Bell avenue, from Broadway to East river, 2¼ miles. C. A. Roullier.

Brazil, Ind.—Sealed proposals will be received until July 7 for grading and graveling about twelve miles of highway. Thos. Phillips, Auditor.

Cincinnati, O.—Sealed proposals will be received until July 16 for paving with brick and setting curbs, Hackberry street. A. P. Butterfield,, Clerk of B. of A.

Sandusky, O.—Sealed proposals will be received until July 16 for paving Osborne street from Hayes to Central avenue with asphalt or brick. Certified check, $1,000. A. W. Miller, City Clerk.

Mt. Vernon, N. Y.—Sealed proposals will be received until July 7 for grading Claremont avenue, between Prospect and Lincoln avenues. Geo. M. Jenkins, City Clerk.

Omaha, Neb.—Sealed proposals will be received until July 10 for grading Davenport street in the village of Florence, the grading not to exceed 12,000 yards. Certified check, $25. M. H. Redfield, County Clerk.

Norfolk, Va.—Bids will be received until July 3 for furnishing 3,000 tons, more or less, of granite paving blocks. Certified check, $100. C. W. Kellinger, Chairman Street, Sewer and Drain Commissioners.

Albany, N. Y.—Sealed proposals will be received until July 6 for paving with dimension granite block, curbing, laying new flag and brick sidewalks, etc., Yates and Colonie streets. Thos. J. Lanahan, Clerk.

CONTRACTS AWARDED.

Denver, Col.—The Pagosa Springs wagon road to Juanita will be built by Archuleta & Taylor for $4,200.

Peoria, Ill.—The Warren-Scharf Asphalt

Trenton, N. J.—Chas. B. Walton was the lowest bidder, June 6, for building the macadam road known as Greenwood avenue and Chambers street, at $1.03 per square yard.

Paving Company was awarded the contract June 19 for paving Seventh avenue. for $29,556.

St. Paul, Minn.—West Third street will be paved by Thos. Reilly for $7,584, and College avenue by P. H. Thornton for $3,249

Gloucester, Mass.—The contract for the improvement of Centennial avenue was awarded to Frank Miller for $2,745.

Oneida, N. Y.—E. R. Boden, Clerk, says that final action will be taken soon for the proposed brick paving on Main street.

Tacoma, Wash.—The bids received June 10 for constructing the Puyallup boulevard were rejected and the work readvertised.

Waterloo, Ia.—The contract for constructing 8,000 yards of brick paving was awarded to J. B. McGorrisk for $11,000.

Boston, Mass.—McEleney Bros. presented the lowest bid, June 12, to the rapid transit commission, for granite block paving.

Denver, Col.—The contract for constructing a road from Rockwood to Silverton was awarded to Grant & Martin of this city for $8,445.

Erie, Pa.—V. D. Eichenlaub was awarded the contract for paving Holland street with Park No. 1 wire cut brick at $1.72 per square yard.

Charleston, Ill.—J. T. Bretz & Son., Springfield, Ill., was awarded the contract for paving in this town.

Fairhaven, Ore.—The contract for constructing three miles of the Cascades road was awarded to John Breckenridge, of this city, for $6,000.

Laporte, Ind.—The contract for laying 14,000 square yards of brick paving was awarded, June 1, to Chas. Kinney, ex-City Engineer at Elkhart.

Rochester, N. Y.—The contract for paving Hayward avenue with asphalt was awarded to Brayer & Albaugh at the rate of $2 per square yard, and aggregating $23,266.

Kankakee, Ill.—Davis & Archer, Bellaire, O., secured the contract for paving several streets in the business section of this town with brick.

Milwaukee, Wis.—William Forrestal was awarded the contract for paving Queen Anne place with cedar block, and H. Vogt & Co. for Florida street.

Troy, N. Y.—The contract for paving Sixth street, from Grand to Federal, was awarded to F. J. Karr, at $1.93 per square yard. Mack brick will be used.

Baltimore, Md.—The contract was awarded June 10 for grading, paving with cobblestones and curbing Patapsco and Luzerne streets to Patrick Reddington.

Hagerstown, Md.—(Special.)—Newton S. Owen says bids have been asked for 700 feet of street paving and more will be done in the near future.

Corry, Pa.—Only two bids were received for paving Main street with brick. The Jamestown Construction Co. bid $1.40 per square yard and James McCloud $1.53.

Lancaster, Pa.—J. U. Fritchey was awarded contracts at $1.99 for paving several blocks of streets with brick. J. G. Galbraith was awarded the contract for Orange and Market streets at $1.84 per square yard.

Fon du Lac, Wis.—The contract for paving East Johnson street with hemlock flooring has been awarded to Louis Schoenlaub at 73½ cents per square yard.

Bedford, Ind.—Shields & DeGolyer bid $19,800 for macadamizing roads in Marshall township and Fillion & Leudtke $15,200 for roads in Guthrie township.

Galveston, Tex.—The contract for surfacing the Nottingham road with Clear Creek gravel or some other equally good material was awarded to Isaac Heffren.

Plymouth, Pa.—The contract was awarded June 15 to Lindsay & Van Loon for paving E. Main street above Bull Run crossing, at $1.58½ per square yard. Mack wire cut brick will be used.

Joplin, Mo.—Contracts have been awarded for grading and graveling as follows: Worley & Ozment, $853.60; Frank Waldridge, $669.54. Burr & Bridges, two contracts, $866.78 and $1,354 each.

Kansas City, Mo.—F. P. McCormick was awarded contracts, June 24, for paving with brick as follows: Broadway, from Third to Sixth, $1.09 per square yard; alley, between Sixth and Seventh, $1.70 per square yard.

Wilmington, Del.—Contracts for furnishing brick were awarded, June 16, as follows: Athens Brick company, $1.05 per square yard; McMahon, Porter & Co., 99 cents; Francis & Ranck, 82 cents; Shale Brick Exchange, $1.06.

Wheeling, W. Va.—The board of public works awarded the contracts for brick paving as follows: Market and Thirty-first street and east side of Jacob street. Henry Robrecht; east side Market street, William and James Carney.

Troy, N. Y.—The contract for paving Federal street with granite, from River street to the river, was awarded, June 20, to Casey & Cavanaugh for $1,480.50; Broadway and State streets, P. Kelly, for $1,722.80 and $1,703, respectively.

Marietta, O.—The contract for 34,315 square yards of paving and 13,893 feet of Berea curbing, bids for which were received June 13, was awarded to W. J. Berry, Bellaire, O., at 65 cents per square yard for paving and 33 cents per square foot for curbing.

Niagara Falls, N.Y.—The Barber Asphalt Paving company secured the contract for 5,120 square yards of asphalt paving on Main street at $2.53 per square yard. The contract for paving Ontario avenue has been awarded to Warren Rodney, who will use Canton shale brick.

GLOVERSVILLE, N. Y.—The Callannan Construction Co. of Albany, N. Y., has been awarded paving contracts in this city as follows: Vermont street, brick on sand foundation, $1.70 per square yard; East Fulton street, brick on concrete foundation, $2.25 per square yard.

St. Paul, Minn.—The Warren-Scharf Asphalt Paving company secured the contract for paving Oakland avenue with asphalt at $2.44 per square yard for the city's share and $2.54 for the street car company's share. The contract for paving Sixth street, from College avenue to Summit, with sandstone and a four-foot strip of brick, was awarded to P. H. Thornton for $3,249.

La Grange, Ill.—(Special.)—Contracts have been awarded to J. H. Esson of Chicago for paving Kensington and Ashland avenues with Galesburg No. 1 repressed brick. Also for macadamizing a system of streets in Ira Brown's addition to the city. The total cost of improvements will be about $60,000.

New Haven, Conn.—The Boston Asphalt company, Boston, Mass., was awarded contracts, June 3, as follows: Chapel street, $3.33 per square yard; Orange street, $3.01 per square yard; Trumbull street, $3.05 per square yard. The New England Improvement company's bids were $2.98, $2.78 and $2.73, respectively, for these streets.

Syracuse, N. Y.—W. J. Gillette was the lowest bidder for the Mulberry street asphaltina pavement at $59,819. This contract was awarded about a year ago to A. F. West for $65,000, but was forfeited because the contractor did not care to undertake the work.

Des Moines, Ia.—Contracts have been awarded as follows: Paving Eighth street, L. L. Black, $1.25 9-10; Sixth avenue, J. W. Campbell, $1.44; School and Tenth streets, J. W. Campbell, $1.41; East Ninth street, Sixth and Walnut streets, Likes Improvement company, $1.32 9-10. Cement curbing contracts on Eighth, College and School streets were awarded to O'Brien & Co., 33¾ cents; Chestnut street, H. H. King, 33 3-10 cents.

Utica, N. Y.—The contract for paving Genesee street was awarded, June 19, to Baxter & Fowler for $22,987.50 for the upper portion and $18,862.60 for the lower portion. Bids were offered by the Utica Paving company, Warren-Scharf Asphalt Paving company, Johnson & Dwyer and the Clafien Paving and Contracting company, whose bids ranged from $24,050.50 to $26,067.75 on the upper portion and from $19,646.10 to $20,853.25 on the lower portion.

New York City—The Warren-Scharf Asphalt Paving company was awarded the contract for the paving of First avenue, from Twentieth to One Hundred and Ninth street, with Trinidad lake asphalt, on their bid of $2.93 per square yard, which was the lowest submitted. The contract requires maintenance of the pavement for fifteen years. The Barber Asphalt Paving company bid $2.98. This is probably the largest single contract for asphalt paving ever let in the United States.

Cedar Rapids, Ia.—(Special.)—E. P. Boynton, city engineer, says that the contract for paving and curbing in district No. 6, bids for which were received June 11, was awarded to the Likes Improvement company of Des Moines. The work included 128,000 square yards of brick, 26,000 cubic yards earth work and 20,000 lineal feet of curbing. The prices at which the contracts were awarded were as follows: 5 by 22-inch curbing, limestone, 48 cents; Berea, 56 cents and cement 36 cents; 5 by 20-inch curbing; limestone, 44 cents; Berea, 54 cents, and cement 30 cents per lineal foot; Des Moines brick on 6-inch concrete foundation, $1.397 and $1.05 per square yard; on 4-inch concrete, $1.254 to $1.27. On 6-inch macadam foundation, $1.159 and $1.615 added to this is Murphy groat filler, 22 cents per square yard; paving pitch, 13 cents; resetting curb, 13 cents. Other bidders were Tschirgi, Steuck & O'Farrell, Berry & Welsh, J. J. Yost, J. D. McGorrisk, W. O. Johnson & Son, A. H. Connelly & Co. and J. E. Murray & Co.

Brooklyn, N. Y.—The contract for the two macadam sections of the Glenmore avenue bicycle pathway was awarded to Thomas F. Byrnes at his bids of $50,778 for the Eastern Parkway end and $42,089.95 for the Glenmore avenue end. Bids were received for the asphalt sections and the Alcatraz company presented the lowest bid, $1.10 per square yard, or an aggregate of $18,515. The Bermudez Asphalt company bid $1.35; Cranford & Co., $1.39, and the Fruin-Bambrick Construction company, $1.50.

Scottdale, Pa.—The contract was awarded, June 10, to Daniel Bennett & Co., of Greensburg, Pa., for constructing 6,850 square yards of brick paving at 35 cents for excavation, 40 cents for curbing, 96 cents for brick paving and 40 cents for stone crossing.

Allegheny, Pa.—The committee on public works awarded contracts, June 5, for the paving of streets to the amount of nearly $300,000. Two-thirds of the paving will be of asphalt. The competition for the asphalt contracts was very lively, and the result will be a saving to the city of about $70,000, as it reduced the price from $2.85 per square yard, which was paid in 1895, to $1.98 and $2 per square yard. The Sicilian Asphalt company secured contracts for fourteen streets at $1.98 per square yard and the Pennsylvania Asphalt company six streets at $2 per square yard.

Wilkesbarre, Pa.—The contract for paving Dana Place, about which there has been so much discussion, has been awarded to Paul F. Dunn at $2.19 per square yard. Bids were submitted for this work by Dunn Bros. and the Barber Asphalt Paving company, the latter bidding $2.49 per square yard. The contract for paving Bennett street, between Washington and Canal, and Livingstone street, between Main and Northampton, with Scranton paving brick on concrete foundation has also been awarded to P. F. Dunn at about 60 cents per square yard.

Minneapolis, Minn.—Bids were submitted by three companies for paving the business districts as follows: Western Bermudez company, limited, streets and car tracks, $2.45 per square yard; streets without car tracks, $2.39; ten years' guarantee and .08 per square yard for repairs during the following ten years. Warren-Scharf Paving company, $2.42 per square yard; repairs for ten years .09 per square yard. Assyrian Asphalt company, streets with car tracks, $2.47 per square yard; streets without car tracks, $2.38; repairs during the second decade, .09. The Warren-Scharf Asphalt Paving company was awarded the contract for streets with tracks, and the Assyrian Asphalt company the streets without tracks.

New York, N. Y.—A contract was awarded May 27, with a fifteen-year guarantee, to the California Asphalt company, for 15,800 square yards of Trinidad lake asphalt on the present pavement in the Boulevard, from Ninety-second to One Hundred and Sixth street, at $2.98 per square yard. The Barber Asphalt Paving company was awarded the contract also, with a five-year guarantee, for 13,700 square yards of asphalt paving in Forty-fourth street, from Sixth to Eleventh avenue, and 5,300 square yards in Forty-sixth street, from Sixth to Eighth avenue, at $2.93 per square yard.

Columbus, O.—The lowest bid received for the improvement of Parsons avenue, from Merion avenue to the south corporation line, was that of A. G. Pugh & Co., whose figures on asphalt with a four-inch concrete foundation aggregated $64,847.60. Bids were received from ten contractors, whose figures covered nearly every variety of street paving material, and the differences between the higheet and lowest bids was less than $8,000. The bid of W. H. Luchtenberg, Trimble brick, with stone foundation, was $33,575.61, and with crushed gravel foundation $33,836.71.

Newark, N. J.—Paving contracts were awarded, June 25, as follows: Granite blocks, Sanford, Poinier and Merchant street, John F. Shanley, $1.68 per square yard; asphalt, Wakeman avenue and Nursery street, New Jersey Asphalt Paving company, $2.50 per square yard. The contracts for paving N. Sixth street, bids for which were opened at a previous meeting, was also awarded to the Barber Asphalt Paving company at $2,251. Ordinances were also introduced at this meeting for repaving Springfield avenue and paving Green street with granite, and Barclay, Summit and Williams streets and Waverly Place with asphalt. Notices of intention were passed for asphalt, oblong granite blocks and Telford paving in sundry other streets.

Newark, N. J.—Paving contracts were awarded June 4 as follows: Bank street, Newark Paving company, $2.59 per square yard, or $9,644; Walnut street, Newark Paving company, $2.59; N. Sixth street, Barber Asphalt Paving company, $2.57, or $8,995; Astor street, Newark Paving company, $2.59, or $5,223. The Newark Paving company was the lowest bidder on Pennsylvania avenue at $2.59, but owing to a technicality in its bond the contract was awarded to John F. Shanley at $1.60 per square yard. The contract for granite block paving on Seventh avenue was awarded to Thomas O'Connor for $19,110.

Baltimore, Md.—Bids were received June 11 for paving with asphalt blocks Mount Royal and Fulton avenues and Pearl street. The contract was awarded June 17 to Jones, Pollard & Co., Philadelphia, as follows: Mount Royal avenue, $2.0643 a square yard. Pearl street, $2.11 a square yard. Fulton avenue, $2.1795 a square yard. At the time that the bids were received protests were made against awarding the contract to Jones, Pollard & Co. A contract was awarded June 19 to the Southern Asphalt Paving company for the repair of sheet asphalt paving, at 73 cents per square yard where the area covers 500 or more square yards of wearing surface of 1½ inches, and 91 cents for 2 inches wearing surface.

Waukegan, Ill.—Flick & Johnson, Davenport, Ia., presented the lowest bid, June 10, for 18,000 square yards of brick paving. For the entire work their bid was as follows: Excavation, 15 cents a cubic yard; new catch basins, $10; catch-basins changed, $2 each; inlets changed, $2; manhole covers reset, $1 each; Berea or Menomonee curb, 39 cents a lineal foot; header, 10 cents a foot; crossing plates, $4 each; cement walk, 13 cents a square foot; macadam, 33 cents a square yard; paving with Streator repressed brick, $1.10 a square yard; Barr Clay company's brick, $1.12; Galesburg standard, $1.115; Galesburg repressed, $1.135; Springfield brick, $1.17; Poston blocks, $1.215; Canton standard, $1.25; Canton repressed, $1.31. There were 12 different bidders.

SEWERS.

Detroit, Mich.—The new chemical sewage system at the Wayne county house has been completed and it is the only plant of its kind in this state.

Worcester, Mass.— (Special.) —Frederick A. McClure, city engineer, says that nothing definite has been determined upon as yet in regard to the sewage disposal system, and in all probability the work will be done by the city sewage department.

Pittsburg, Pa.—Bids were opened June 3 for sewer work, the total cost of which will aggregate $200,000. Between 300 and 400 bids were opened and bids were received from more than twenty-five contractors. None of the items of the work had less than three competitors and as many as ten and fifteen contractors competed for the sewers. The prices quoted were somewhat lower than for similar work done last year.

Rome, N. Y.—The most difficult piece of work encountered so far in the construction of the sewerage system has been the cut of nineteen feet on Jay street, which is one of the deepest on the whole line. Clay, hardpan, cement gravel and water have been encountered, making it impossible to make rapid headway with the work. In all, about two and a half miles of pipe have been laid out of the twenty-eight miles specified in the plans. Another unexpected obstacle that has arisen has been the difficulty in getting good men.

Des Moines, Ia.—The East Side intercepting sewer is nearly completed. The driving of the tunnel for the sewer, which is 4,000 feet long and six feet square throughout, is completed, and it is the largest of its kind in Iowa, and one of the largest sewer tunnels in the country. Kavanaugh & O'Connell, the contractors, are now constructing about 2,300 feet of open ditch work, which they expect to be able to turn over to the city completed in the fall. The contract was awarded July 11, 1894, and since September, 1894, they have been engaged constantly, day and night, in driving the tunnel.

Passaic, N. J.—Drs. Marsh and Herald and William T. Hunt of the Passaic Valley Sewerage Commission visited Boston and Lawrence, Mass., recently to inspect the sewerage systems. Information is being collected by Secretary Scott of the commission concerning chemicals and other materials used in all the manufactories which are drained in the Passaic river.

CONTEMPLATED WORK.

Butler, Pa.—Sewers and paving are contemplated.

Havana, Ill.—A sewerage system is contemplated.

Oskaloosa, Ia.—Surveys are being made for sewers.

Palatka, Fla.—Bonds will be issued for sewers.

Barnesville, Minn.—A sewerage system is badly needed.

Milford, N. Y.—The construction of sewers is contemplated.

Milaca, Minn.—A sewer is proposed for C. street.

Morris, Minn.—A sewer in Atlant' avenue is contemplated.

Scranton, Pa.—Sewers are proposed for Columbia and Sunset avenues.

Winona, Minn.—Plans have been completed for sewer district No. 2.

Kewanee, Ill.—A sewerage system is contemplated for this place.

Lynn, Mass.—The council has voted to issue $40,000 in sewer bonds.

Moline, Ill.—About 8,000 feet of sewers will be laid this season.

Biddeford, Me.—A new brick sewer will be constructed in Grove street.

Chillicothe, O.—A sewer has been ordered in Broadway street.

Sherburn, Minn.—A petition is being circulated for a sewerage system.

Mason City, Ia.—Plans are being prepared for the proposed big sewer.

Delhi, N. Y.—A report for the proposed sewerage system has been made.

Cadillac, Mich.—The main sewer will be extended a distance of 3,700 feet.

Perry, Ia.—The council has been asked to provide for a sewerage system.

Concord, N. H.—A sewer is proposed in Giles street, to cost about $35,000.

Corning, Ia.—A sewer from the court house to the river is being agitated.

Stratford, Ia.—A system of deep drainage is contemplated by the city council.

Northampton, Mass.—The city has voted to expend $5,000 for the construction of sewers.

Detroit, Mich.—A resolution has been passed ordering the construction of three sewers.

Charles City, Ia.—Surveys for a sewerage system are being made by W. S. Shields of Chicago.

Devil's Lake, N. D.—The construction of a sewer on Fourth and Kelly streets is contemplated.

Leicester, Mass.—An appropriation has been made for building sewers in Grove street and Washburn square.

Atlanta, Ga.—The ordinances for the construction of sewers will be acted upon by the council July 6.

Leechburg, Pa.—Plans for a sewerage system for this place will be made by Wilson & Smith of Saltsburg.

Grand Rapids, Mich.—Sewers have been ordered built on N. Prospect, N. Lafayette, Trowbridge and Hastings streets.

San Jose, Cal.—Plans have been ordered prepared for enlarging the Eighth street sewer to 18 inches.

Lyons, N. Y.—The question of constructing sewers at a cost of $50,000 is under consideration.

Hamilton, Can.—The by-law to raise $85,000 to establish sewage disposal works has carried.

Spokane, Wash.—The city commissioners contemplate building the Cannon addition sewers by day labor.

Anaconda, Mont.—The question of issuing $20,000 to extend the sewerage system has been defeated.

College Point, N. Y.—Plans for a sewer in Eighth avenue have been ordered prepared.

Sacramento, Cal.—The question of constructing a $65,000 sewage disposal plant will be voted on.

Springfield, Mass.—Sewers will be constructed on N. Elm, Locust and East streets and Highland avenue.

Bellevue, Pa.—An issue of $75,000 in bonds for sewers and paving is proposed. Hugh Kennedy, Councilman.

East Greenwich, R. I.—The construction of a sewerage system, to cost about $8,000, has been favorably voted for.

Philadelphia, Pa.—An ordinance authorizing the extension of the Cresheim main sewer in Germantown has been passed.

Deering, Me.—The order appropriating $2,336.50 for constructing the Grant, Prospect and High street sewers has passed.

Waukesha, Wis.—The construction of sewers will be recommended by the Board of Public Works. H. E. Blair, Comptroller.

Waukesha, Wis.—(Special.)—J. M. Kerr, City Clerk, says that 2,982 feet of 10-8-inch pipe sewers will be constructed.

Bay City, Mich.—Estimates have been submitted for a brick sewer 5,675 feet long in Fourteenth street. John F. Eddy, Chairman B. P. W.

Ironton, O.—An ordinance has passed its first reading for a sewer in the Fourth District at an estimated cost of $16,500.

Brockton, Mass.—The construction of sewers has been authorized in Chester avenue, Newbury, Belmont, Arlington and West Elm streets.

Trenton, N. J.—Ordinances have been authorized for the construction of sewers in Market, Hudson, Asbury, Third and Broad streets and Clinton avenue.

Spartansburg, S. C.—A petition is in circulation asking for an election to vote on the issue of $50,000 bond for constructing a sewerage system.

Manchester, N. H.—The sewer and drains committee has voted to construct a sewer from Merrimac street east of Beacon to Hanover street, and on C street.

Syracuse, N. Y.—The common council has declared its intention to construct pipe sewers in W. Willow, Pond, W. Water, Gazelle and E. Genesee streets.

Cleveland, O.—Plans have been prepared for the proposed sewerage system in West Cleveland and for sewers in twelve streets. E. A. Roberts, Secretary Board of Control.

Oswego, N. Y.—The city engineer has been instructed to make plans and specifications for a sewer in W. Ninth street, between Seneca and Schuyler streets.

Rutheford, N. J.—The question of bonding for $40,000 for a system of sewerage and macadamizing streets is being considered by the citizens of East Rutheford.

Naugatuck, Conn.—The proposed system of sewerage and sewage disposal works will be designed by T. H. McKenzie of Southington, Conn. Geo. C. Ham, Resident Engineer.

Medford, Mass.—An appropriation of $21,000 has been made to continue sewer work and $1,500 for building a drain on High street, from Sharon to the river.

Jamaica (L. I.), N. Y.—Specifications for the new system of sewerage in accordance with the new plans introduced by Col. Aaron D. DeGrauw, have been prepared by Engineer McLaughlin.

Council Bluffs, Ia.—An ordinance has been passed by the city council for 10-8-inch sewer in South First street and an 8-inch sewer in Graham avenue.

Woonsocket, R. I.—The committee on sewers has adopted a resolution appropriating $95,000 for the construction of so much of the sewerage system as is embraced in its accompanying report.

Alliance, O.—(Special.)—O. W. Pfouts, city engineer, says that after the sewage disposal plant is completed sewers will be constructed during the summer in District Nos. 24, 21 and 27.

South Bethlehem, Pa.—The ordinance committee has been instructed to prepare an ordinance providing for a sewerage system and the submitting of the matter to a vote of the people next fall.

Watertown, Mass.—An appropriation of $70,000 is reported for constructing a sewerage system in the eastern end of this town, which, it is proposed, will be connected with the metropolitan system.

Northfield, Minn.—An amendment to the ordinance for the Second street sewer has been made by the council, which provides for extending it from Second to Fourth streets on Nevada.

Swarthmore, Pa.—The proposed building of filtration beds is about to be given up, and it is probable that the sewage will be carried to tidewater. A. Prescott Folwell, Philadelphia, Engineer.

Memphis, Tenn.—A report has been prepared for the council by Sewer Engineer Eliott in which he recommends the construction of a main sewer at the north and one at the south end of the city.

Norristown, Pa.—Ordinances have been passed for a vitrified pipe sewer on DeKalb street, with lateral connections of 4-inch pipe terminating in a double Y, and with a flush tank of 500 gallons capacity.

Paterson, N. J.—The board of aldermen have given notice of intention to construct a sewer, as follows: Grand street, 200 feet, 12-inch pipe; E. Twenty-second street, 500 feet, 12-inch pipe; Court street, 1,200 feet, 36-inch brick.

Middletown, O.—A report has been received by the city council from Civil Engineer Dillon regarding an extensive sewerage system which is proposed for the southeastern part of the city, at an estimated cost of $76,000.

Lynn, Mass.—The residents of the western section of this city are anxious for the construction of sewers and drains for the extension of the outfall sewer.

Ft. Wayne, Ind.—A declaratory resolution has been passed providing for a 12-inch crock sewer in the first alley south of Hayden street, from Winter to Gay.

Chillicothe, O.—The sewer commission is strongly in favor of having an entire sewerage system put in, believing that this plan is the best and cheapest. J. P. Force, C. E., of Fostoria, O., estimates that the entire system with everything complete would not cost to exceed $94,000.

Dunkirk, N. Y.—Chas. C. Parker, chairman of the sewer committee of the council, estimates the cost of the sewers east of Central avenue at from $700 to $900 each. It is the committee's intention to run four sewers to the water line this season, viz.: Eagle, Swan, Dove and Robin streets.

Newark, N. J.—The cost of the proposed East Branch intercepting sewer is estimated at $97,000. The sewer is to be of brick and will be about 6,500 feet long. It will vary in size from 3 feet 2 inches by 4 feet 9 inches to 3 feet 8 inches by 4 feet 10 inches.

Worcester, Mass.—The committee on sewers, after a trip of investigation to some of the localities in which new sewers are needed, voted to recommend the construction of sewers in Chrone, Providence, West Fremont and New York streets. On the west side the recommendation will include sewer construction from Newton Square to Midland street and in Midland and Buffalo streets.

Worcester, Mass.—A report has been presented to the city council by the committee on sewers, recommending an entire separation system of the sewage and the surface water of the city, in order to comply with the law which requires Worcester to purify its sewage before turning it into the Blackstone. The plan involves the construction of a new system of sewers at an estimated cost of $892,000.

Pontiac, Ill.—Bids will be advertised for the work of construction only for the south side sewer. But one bid was received recently for this sewer, and that was $400 in excess of the estimate. The specifications will be changed so as to allow use of ordinary socket sewer pipe instead of deep socket. Bids have also been authorized for a sewer on N. Mill street, between Howard and North.

CONTRACTS TO BE LET.

Quincy, Ill.—Bids will be asked at once for 37 blocks of sewer work. E. R. Chapman, City Engineer.

Trenton, N. J.—Bids will be received until July 7 for constructing sewers in sundry streets. C. Edward Murray, City Clerk.

Bath-on-the-Hudson, N. Y.—Sealed proposals will be received until July 6 for laying a 12-inch sewer. J. B. McNary, Village Clerk.

Fargo, N. D.—Bids will be received until July 8 for constructing a 9-inch sewer to connect the vaults of the Court House and jail with the sewer on Third avenue, south.

Farmersville, Cal.—Sealed bids will be received until July 18 for constructing three-quarters of a mile of ditch. D. L. Wilson, Visalia, Cal.

Fulton, N. Y.—Sealed proposals will be received until July 10 for constructing a system of sewerage. Armin Rice, Clerk Board Sewer Commissioners.

Paw Paw, Mich.—Bids will be received until July 7 for constructing a drain known as the Conklin drain. Geo. Mutchler, County Drain Commissioner.

South Bend, Ind.—Sealed proposals will be received until July 27 for laying pipe sewers in William and Franklin streets. L. A. Hull, City Clerk.

Stillwater, Minn.—Bids will be received until July 7 for constructing a sanitary sewer in Sixth street. Bond, $500. Wynn Shepard, City Engineer.

Clinton, Mo.—Sealed proposals will be received until July 7 for constructing 1,950 feet of 15-inch sewer. Certified check, $100. H. C. Allen, City Engineer.

Saratoga Springs, N. Y.—Sealed proposals will be received until July 7 for constructing an 8-inch terra cotta pipe sewer in Cottage street. Jas. D. McNulty, Clerk.

Chicago, Ill.—Sealed proposals will be received until July 3 for laying private drains in sundry streets and avenues. Certified check, $200. W. D. Commissioner.

Yankton, S. D.—Bids will be received until July 6 for constructing an 8-inch lateral sewer in the alley through blocks 25 and 34, from Third to Sixth streets.

Michigan City, Ind.—Sealed proposals will be received until July 3 for constructing an 8-inch tile sewer in Washington street. Certified check, $200. Albert H. Leist, City Clerk.

College Point, N. Y.—Sealed proposals will be received until July 6 for the extension of the sewer by wooden sewer at the foot of Eighth street. Thomas E. Gann, Chas. Michel, Street Commissioners.

Amsterdam, N. Y.—Sealed proposals will be received until July 2 for constructing storm water sewers in Locust avenue and Bridge street. Bond, $300. Geo. McClumpha, Secretary Sewer Commissioners.

Tampico, Ill.—Sealed proposals will be received until July 7 for constructing 22.5 miles of drainage ditches in the Union Special Drainage District of Fairfield, Greenville and Gold. Lee W. Brown.

Rock Island, Ill.—(Special.)—Sealed proposals will be received until July 6 for a storm drain, 4 feet in diameter and 4,000 feet long. Certified check, $500. W. A. Darling, City Engineer; A. D. Huesing, City Clerk.

Omaha, Neb.—Sealed proposals will be received until July 10 for furnishing brick, sand and cement and for the construction of a brick culvert in Douglas precinct. Certified check, $25 each. M. H. Redfield, County Clerk.

Dayton, O.—Sealed proposals will be received until July 7 for constructing storm water sewers in Main street, as follows: 1,280 lineal feet 15-inch pipe sewer; 50 lineal feet 12-inch; 11 catch basins, seven man holes; certified check, $1,000; also, until July 21 for storm water sewers in Wayne avenue and Anderson street, as follows: 1,810 lineal feet 36-inch and 2,434 lineal feet 30-inch brick sewer, 90 lineal feet 24-inch and 970 lineal feet 12-inch pipe sewer, 44 catch basins, 12 manholes; certified check, $1,000. S. C. A. Herbig, City Comptroller.

Warren, Pa.—(Special.)—Sealed proposals will be received until July 20, postponed from June 20, for the construction of a sewer system for the Fifth and Sixth wards. Bidders to furnish their own plans and specification. John Masterson, Chairman of Sewer Committee.

Barnstable, Mass.—Sealed proposals will be received until July 6 for constructing 1,625 feet 8-inch sewer; certified check, $200; also, for furnishing 1,460 feet 8-inch, 460 feet 6-inch and 100 feet 4-inch vitrified sewer pipe; certified check, $50. Brick, pipe, cement and iron castings will be furnished by the commissioners. John H. Clark, Member of Board of County Commissioners.

CONTRACTS AWARDED.

East Orange, N. J.—The contract for building a sewer in Russell avenue was awarded to Dowd & Co.

Fon du Lac, Wis.—The contract for sewer work was awarded to M. C. Connors of Kaukauna for $3,000.

Williamsport, Pa.—The contract for the E. Third street sewer was awarded to Ward & Stucker for $1,020.90.

Milwaukee, Wis.—The bids received May 28 for furnishing sewer brick were $6.90, $7.35, $7.92 and $7.75 per thousand.

Menasha, Wis.—The contract for constructing the Racine street sewer has been awarded to J. H. Green & Son, of Appleton.

Evanston, O.—The Middletown Paving company, Middletown, O., secured the contract for constructing sewers for $1,529.73.

Minneapolis, Minn.—The contract for supplying about 500,000 sewer brick was awarded to Reidler & Aronson of Chaska, at $6.25 per thousand.

Red Wing, Minn.—The contract for constructing a sewer on Fifth street was awarded to P. H. Thornton, of St. Paul, for $1,957.

Aurora, Ill.—The contract for constructing sewers in District No. 4 has been awarded to Tole & Lakin, of Rockford, for $11,567.

Gowanda, N. Y.—The contract for constructing the sewerage system has been awarded to William B. Wilson & Co., of Buffalo, N. Y., for $15,659.50.

Rochester, Minn.—The contract for constructing the Main and Prospect streets sewers was awarded to K. A. Smith & Co., of Minneapolis, for $2,598.

Red Oak, Ia.—John Hurley & Co., Des Moines, secured the contract for constructing 8,646 feet of 6-8-10-inch tile sewer in this town for $2,296.

Philadelphia, Pa.—James Sullivan, 1430 S. Penn Square, was awarded the contract, June 9, for constructing a main sewer in Forty-sixth-st., for $30,000.

Palmer, Mass.—The contract for a 15 to 8-inch pipe sewer in Thorndike and W. Main streets has been awarded to M. J. Dillon, as follows: Sewer, $0.275 per foot; manholes, five, $23.75; catch-basins, seven, $17.90.

Syracuse, N. Y.—The contract was awarded, June 15, to Belden & Dwyer, city, for constructing one and one-quarter miles of 87 by 58 to 45 by 30-inch brick sewer for $61,605.

Scranton, Pa.—Bids were received, June 18, for constructing 410 feet of 10-inch pipe sewer. The lowest bid was presented by P. Thornton & Co., $1.84 a lineal foot.

Alexandria, Va.—D. J. Howell, who has the contract for constructing the King street sewer, has awarded to G. H. Robinson's Sons the contract for furnishing 1,000 barrels of cement.

Allegheny, Pa.—Sewer contracts were awarded, June 5, as follows: John Hurley, $1,438; William J. Dunn, $1,074; M. M. Gallagher, $1,089; Sloan, McIlvaine & Ott Bros., $968.

Harrisburg, Pa.—Ward & Stucker were awarded the contract for constructing the Seventeenth and Chestnut street sewer for $868.45, and the Fourth street sewer for $622.50.

Red Bank, N. J.—The contract for constructing a section of the sewerage system was awarded to R. B. Mitchell & Co. of Brooklyn, N. Y., for $3,054.16.

New York, N. Y.—The lowest bid presented, June 11, for constructing a sewer across Mosholu Parkway and Bronx Park was that of M. Redmond of Woodlawn, which was $39,943.

South Norwalk, Conn.—The contract for constructing sewers in Loundes avenue, Woodward avenue and Meadow street has been awarded to Salvator Chariot of this city for $2,305.

Tunkhannock, Pa.—The contract for constructing a sewerage system was awarded to P. J. Dunn of Scranton for $12,417. The bids, eleven in number, ranged from $15,500 to $20,000.

Binghamton, N. Y. — (Special.) — H. Ward, city engineer, says that the contract for constructing the Laurel avenue main sewer was awarded to E. Whalen & Co. for $12,423. The small sewers are being built by the city by days' labor.

Latrobe, Pa.—Bids were received for constructing 1,800 feet of 12 and 15-inch terra cotta pipe sewers as follows: John Herrmann, $1,218; Thomas Pattinger, $1,381; J. C. Spaith, Pittsburg, Pa., $1,627; James McConaughy & Sons, Greensburg, Pa., $2,725.

San Antonio, Tex.—Bids were received June 4 for constructing a sewerage system at Ft. Ringold as follows: John Mix, Rio Grande, Tex., $5,275; James McCay, Brownsville, Tex., $4,826; John T. Smith, Austin, Tex., $4,439; Z. O. Hooker, San Antonio, $6,400.

Newark, N. J.—Contracts for sewers were awarded June 25 as follows: Mulberry-place, $271; Market street, $1,230.50, and Avon avenue, $8,141.45, Headley & Christie; Jackson street, James McGuire, $584; Mt. Prospect avenue, $1,619.75; Polk street, W. J. Hughes, $332.

Davenport, Ia.—Flick & Johnson were the lowest bidders on the Harrison street sewer at $2.97 per lineal foot; Thirteenth and Cary avenue sewer, Thomas Boyd, 57 cents; Seventh and Warren streets sewers, Patrick Connelly, 31 cents; Second and Iowa, Hans Osbar, 54½ cents.

Erie, Pa.—David Jones secured the contract for constructing a sewer in Cherry street at 90 cents a foot for straight and curved twelve-inch pipe, $1 per foot for branch pipe, 40 cents a foot for 9-inch pipe, 35 cents a foot for 6-inch connections and $35 each for catch basins and manholes.

Cedar Rapids, Ia.—(Special.)—E. P. Boynton, city engineer, says that the contracts for constructing sewers were awarded, June 11, as follows: First and Second avenues, storm sewer, M. S. Jackson & Co., city, $7,677; Central park, Murray Bros., city, $11,533; Vinton ditch, Ford & De La Hunt, city, $9,495.

Indianapolis, Ind.—The contract for a main sewer with branches in Garden street, from Senate avenue to Illinois street, has been awarded to the Indiana Construction company at $1.55 per lineal foot; local sewer on the north lawn of Vermont street, from Massachusetts avenue to New Jersey street, Shinn Bros., $1.04.

Springfield, Mass.—Contracts for the construction of sewers have been awarded as follows: Section 1, McKenzie & Peterson, city, $12,568.83; section 2, Acock & Low, Trenton, $3,972.75. The contract for about 5,000 feet of pipe sewer on Elm and Westfield streets and Maple Terrace was awarded to Sackett Bros. for $1,200.

Grand Rapids, Mich.—(Special.)—H. A. Collar, city engineer, says sewer contracts have been awarded as follows: Valley avenue and First street, J. O'Hara, $1,722.16; Ninth avenue, J. Van Ess, $380; Lake avenue and other streets, Madison S. Cloate, $8,190; Jackson street, J. Heerschapp, $103; Carlton and Lake avenues, B. S. Regt, $2,405; Wealthy avenue, B. S. Regt, $1,437.51.

Adrian, Mich.—Bids were received for constructing a pipe sewer in College avenue as follows: John Tynan, city, 42⅛ cents per lineal foot; William McMahon, Toledo, O., 42 to 51 cents per lineal foot; Madlem & Firk, Goshen, Ind., 35 to 40 cents per lineal foot, and back filling from 21½ cents to 74 cents; Peterson & Co., West Bay City, Mich., 27 cents to 78 cents per lineal foot, or $1,721.

Lowell, Mass.—The contract for furnishing vitrified sewer pipe was awarded to Staple Bros., city, as follows: Socket pipe 12 by 15-inch., 77¼ per cent. off standard list price; 18 to 24-inch., 77½ per cent. off; ring pipe, 12 to 15-inch, 76⅝ per cent. off; 18 to 24-inch, 77⅜ per cent. off; deep socket pipe, 2 to 18-inch, 75 per cent. off; 20 to 24-inch, 72½ per cent. off. The contract for sewer brick was awarded to Edward Cauley at $6.45 per 1,000.

Milwaukee, Wis.—Sewer contracts have been awarded as follows: Marietta, Shepard, Summit, Hackett and Hartford avenues, 3,678 feet, Frank Nagielski, $1.12 a foot; Concordia avenue and Sixth street, 2,470 feet, and 323 feet in Clark street, G. E. Zimmerman, $1.07; Twentieth avenue and Maple street, A. Kellner, 95 cents; Well and Bremen streets, 1,156 feet, M. Chybowski, $1.27; Grant street and Washington avenue, 1,015 feet, brick sewer, $3.49, and 72 feet of pipe sewer, $1.80; Walker street, 276 feet, Hermann Hohense, 98 cents; alley in block 18, 452 feet, James O'Donnell, $1.21.

Geneva, N. Y.—Sewer contracts have been let to the following bidders: Iron work, F. H. Coffins, New York City; pipe, Corwin, & Rose, city; outfall, Clement & Co., Niagara Falls; sewers, Walker & Robinson, Troy, O. The aggregate amount of the contracts is about $63,000.

San Antonio, Tex.—Bids were received June 10 for completing the sewers. The bids were invited on two propositions, the first to construct the inverts of the sewers of brick absorbing not exceeding 16 per cent. of water, other portions of the sewer to be built of hard selected brick; second, to use only 16 per cent. brick. The Greenville Construction company was the lowest bidder on each proposition. The bids were as follows: To use 16 per cent. brick in the inverts only, Greenville Construction company, $241,292.42, 220 days; G. R. Crandall, $258,788,82, 400 days; Schryver & Berg, $263,577.20, 300 days; Nelson & Co., $266,532.02, 175 days; Otto P. Kroeger, $668,935.80, 225 days; Howard Neeley, $278,167.13, 200 days. To use 16 per cent. brick in all of the work: Greenville Construction company, $251,678.57, 300 days; G. R. Crandall, $258,788.82, 400 days; Schryver & Berg, $269,577.20, 300 days; Nelson & Co., $267,166.94, 225 days; Otto P. Kroeger, $270,353.45, 325 days; Howard Neeley, $284,223.38, 250 days. The contract was awarded to the Greenville Construction company of Greenville, O.

WATER-WORKS.

Columbia, S. C.—An infiltration reservoir and standpipe are proposed.

Bolivar, N. Y.—A gravity system of water works is contemplated.

Rockville, Ind.—The question of water works is being agitated.

Lexington, Mass.—Bonds have been voted for the extension of water mains.

East Chicago, Ind.—The water mains will be extended about two and a half miles soon. William Hale, clerk.

Cerro Gordo, Ill.—Bids will soon be asked for the proposed water works system.

Harrisburg, Pa.—Plans for a filtration plant are being discussed by the council.

Silver Creek, N. Y.—Three engineers are engaged on plans for a proposed water works system.

Palo Alto, Cal.—Plans for the municipal water works system are being drawn by C. E. Moore.

Beatrice, Neb.—Proposals are wanted by S. K. Davis, water commissioner, for a pure, clean water supply.

Escanaba, Mich.—No definite action regarding the construction of water works has yet been taken.

Buchanan, Mich.—The addition of a stand-pipe to the present water works system is contemplated.

Mt. Holly, N. J.—Some trouble is being experienced by this city because of unpleasant drinking water.

Grand Rapids, Mich.—The question of an insufficient water supply is being discussed by the board of public works.

Franklin, La.—Surveys have been made and plans prepared for water works.

Plymouth, Ill.—A committee was appointed recently to prepare plans and specifications for a system of water works.

Norwalk, O.—Bids will soon be invited for the proposed new reservoirs and dams. A. F. Rolan, secretary.

Westport, Mo.—An election will be held July 1 to vote $75,000 in bonds for extension of water mains.

Ballston Spa, N. Y.—Surveys and estimates for the proposed additional water supply are being made by H. M. Deer.

Booneville, N. Y.—The water commissioners, E. B. Austen, J. P. Babcock and S. A. Johnson, are investigating water supply, etc.

Carbondale, Pa.—An ordinance providing for an issue of bonds for water works improvements has been passed by the council.

The water works question will be voted on as follows: Hellertown, Pa.; Hastings, Mich.; Bolivar, N. Y.; Grimsby, Ontario, Canada.

Pleasantville, N. Y.—This village would be pleased to know the cost of constructing water works. E. P. Swift.

Lisbon, N. D.—A petition has been presented to the council asking for the extension of water mains to the east side of the river.

Pittsfield, Mass.—An order for an appropriation of $26,000 for the extension of water mains has been reported by the committee on finance.

Wurtsboro, N. Y.—An application has been made to the village officers by an organized company to put in a system of water works.

Fertile, Minn.—Plans and specifications for the proposed water works system will be prepared by C. F. Loweth, C. E., of St. Paul, Minn.

Victor, N. Y.—Surveys for the proposed water works system have been made by Le Grande Brown, C. E., who estimates the cost at $25,000.

Nogales, Ariz.—The council has adopted an ordinance authorizing H. K. Chenoweth to construct and maintain a water works system in this city.

Vailsburg, N. J.—A petition has been received from the property-owners asking that $30,000 in bonds be issued to establish a water works plant.

Lester Prairie, Minn.—Plans and specifications for the proposed water works system have been received by the council, which will soon let the contract.

St. Joseph, Mo. — A committee has been appointed to consider the question of a new water supply after the expiration of the present contract in 1899.

Toledo, O.—Water main extensions have been ordered in Utica, Superior, Buckeye, Moore, Michigan, Germania, Delaware, La Grange and Walbridge streets.

Suisun City, Cal.—An election will be held July 13 to vote on the question of issuing $42,000 in bonds for water works construction. O. B. Powers, Town Clerk.

Anaheim, Cal.—The question of issuing $18,000 in bonds for the extension and completion of the city water and electric light plants will be voted on August 1.

Rushville, Ill.—According to press reports new works will have to be constructed, as the present plant is being destroyed by the artesian water now in use.

The construction of water works systems has been favorably voted on at the following places: Philips, Me., Tippecanoe, O., Le Roy, Minn, Wellman, Ia., Pennsburg, Pa., Union, S. C., Laurens, S. C., Bancroft, Neb.

Tonawanda, N. Y.—The board of trustees have decided to call an election to vote on issuing $125,000 in bonds for the extension and enlargement of the water works.

Sinclairville, N. Y.—Extensive improvements, including the laying of more than a mile of new water mains to the springs, is contemplated by the water company.

Perth Amboy, N. J.—The board of aldermen, acting on the recommendation of the committee on water, has ordered that a "thoroughly competent engineer" be engaged.

South Riverside, Cal.—The present water works system is inadequate. The extension of the system and replacing 4-inch mains with large pipes is advised.

Edwardsville, Ill.—Messrs. Schulze, Edmonds and Little have been appointed a committee by Mayor Prickett to ascertain the best method of securing water works.

Tuckahoe, N. Y.—Surveys are being made for a large reservoir two or three miles west of this place, and the extension of water mains to Scarsdale by the New Rochelle Water company.

The ouestion of water works is being agitated at the following places: Stockton, Ill., Breakabeen, N. Y., Pleasantville, N. Y., Pennsburg, Pa., Salmon, Idaho, Alden, N. Y.

Tripp, S. D.—A committee consisting of F. A. Morris, James Hassett, John McLean, Chr. Friedrich and Will Rath has been appointed to investigate and obtain estimate on a water works system.

Indianapolis, Ind.—The agitation over the pollution of the Indianapolis water supply has resulted in the water company agreeing to at once begin the work of providing sand filtration, in accordance with the requirements of the Board of Health.

Great Neck, N. Y.—M. A. McClure and Frank Murphy of the Great Neck Improvement society, have been appointed a committee to confer with the town board with reference to putting in water works at Success Pond and laying water mains to Great Neck and Manhasset.

Santa Barbara, Cal.—The city engineer has been instructed to draw plans and specifications for the cost of using sea water for streets and sewers; that said plans shall contemplate the ultimate use of fresh water.

Piqua, O.—A resolution has been adopted by the city council declaring it necessary to issue bonds for the purpose of extending, enlarging and improving the water works system and calling an election for July 6 to vote upon the question of issuing bonds not to exceed $20,000. Seth McCulloch, clerk.

Wilkesbarre, Pa.—Alexander Potter, C. E., New York City, has been engaged as chief engineer of the Spring Brook Water Supply Company, and will have charge of all engineering work for the company with several corps of engineers at work under his direction at Pittston.

Bangor, Me.—The water board has authorized A. B. Tower, consulting engineer of Holyoke, Mass., to complete the plans and specifications for the proposed water works improvement and to ask for bids for a pumping engine of 5,000,000 gallons capacity, and for five water wheels.

Mt. Vernon, N. Y.—The commissioners on water supply have elected officers as follows: President, Charles E. Bigelow; treasurer, Samuel A. Swart; secretary, Louis T. Townley. The work of investigation will soon begin, and experts and others having knowledge of the needs of the city and of its sources of water supply will be invited to consult with the commissioners.

CONTRACTS TO BE LET.

Malvern, O.—Bids will be invited in July for a water works system. George R. Walton, Secretary.

Keosauqua, Ia.—Bids will be received until July 8 for building a water works system. A. Wilkin, Mayor.

Delphos, O.—Sealed proposals will be received until July 7 for constructing a water works system. G. F. Almy, Secretary Board of Trustees.

Ripley, O.—Sealed proposals will be received until July 6 for constructing water works. L. Vern Williams, Clerk Board Water Works Trustees.

Pella, Ia.—Sealed proposals will be received until July 8 for the installation of a system of water works. D. S. Huber, Chairman on Water Works.

Gilbertsville, N. Y.—Sealed proposals will be received until July 11 for constructing a complete system of water works. Certified check, 3 per cent. W. M. Deitz, Clerk.

Deckertown, N. J.—Sealed proposals will be received until July 6 for constructing a water works system. William S. Vanderhuff, Secretary Board Water Commissioners.

Columbus, O.—Sealed proposals will be received until July 20 by the trustees of the Ohio Institution for the Blind for constructing a steel standpipe and laying water mains. Hiram P. Crouse, President.

CONTRACTS AWARDED.

Sandusky, O.—The contract for furnishing water pipe was awarded to Bauer & Schnaitter.

Chelsea, Mich.—The common council has contracted with F. P. Glazier for a system of water works.

Souderton, Pa.—B. G. Coons, Kingston, Pa., was awarded the contract for constructing water works in this place for $9,911.

Searsport, Me.—Charles Baker of Belfast secured the contract for constructing water works in this city. J. H. Sullivan, clerk.

Hokah, Minn.—The contract for putting in a water works system was awarded to Fetter & Crosby of La Crosse, Wis., for about $6,000.

Orwigsburg, Pa.—The contract for building a reservoir has been awarded to William McAdams of Pottsville for $10,000.

Manchester, N. H.—The contract for constructing water works was awarded to the C. H. Eglee Company of Boston for $45,000.

Petrolea, Ontario, Can.—The contract for constructing water works was awarded to William Ganson & Co., St. Catherine's, Ont., for $131,945.

Grand Junction, Col.—The contract for building a new water works system, at a cost of nearly $200,000, has been awarded to Mitchell Bros. of Denver.

North Adams, Mass.—The Board of Public Works has awarded the contract for finishing the Notch reservoir to D. Cuozzo of New York for $24,000.

Meriden, Conn.—James Malloy & Co. of Portland, Conn., secured the contract June 8 for building a reservoir, dam and canals for $62,189.50.

Middleton, Mass.—The contract for building a new reservoir and laying pipes to connect with the same has been awarded to the C. H. Eglee Company of Boston for $11,000.

Glassboro, N. J.—A contract has been closed with the American Pipe Company of Philadelphia for the construction of water works in this place.

Story City, Ia.—The contract for a water works system was awarded to Wib. F. Clements of Ottumwa and Jackson & Moss of Des Moines the contract for the pipe line. The pipes aggregate in cost $5,567.

Angelica, N. Y.—Contracts have been awarded for constructing water works as follows: Construction of work, M. B. Birdseye, Fayetteville, N. Y.; pipe, Chattanooga Pipe Company; hydrants, Ludlow Valve Company; valves and boxes, Troy Valve Company.

BRIDGES.

Smithton, Pa.—A new steel bridge to cross the Youghiogheny is contemplated.

Carthage, Mo.—A larger bridge is contemplated to replace the lower bridge.

Franklin, N. H.—The question of a new bridge is being agitated for the Winnipeseoge.

Williamsport, Md.—The construction of a bridge across the Potomac river is contemplated.

Westphalia, Kas.—An iron bridge will probably replace the wooden bridge south of this town.

Elmira, N. Y.—A new iron bridge across Hoffman creek at W. Church street is contemplated.

Earlham, Ia.—A petition is being circulated asking for a county bridge east of this town.

Connellsville, Pa.—An iron bridge is proposed over the ravine at Clump's run. S. F. Hood.

Tacoma, Wash.—As soon as the plans are completed the bicycle bridge from S. Thirtieth to Thirty-first street will be advertised.

Cumming, Ga.—Bids will be received until July 25 for building an iron and steel bridge. H. L. Hawkins, Ordinary, Forsyth Co.

Harrisburg, Pa.—A bridge is contemplated over Armstrong creek, near Enders, Dauphin county.

Grafton, N. D.—Bids will be received until July 8 for all county bridges for the ensuing year.

Rockville, Ind.—A petition is being circulated asking for a bridge across Sugar creek, at Cox's ford.

Enders, Pa.—A petition is being circulated for the erection of a county bridge over Armstrong creek.

El Dorado, Kas.—Bids will be received until July 27 for four arch stone culverts. Jacob W. Baker, trustee.

West Newton, Pa.—A new steel bridge will be constructed across the Youghiogheny river, at Smithton.

Pembina, N. D.—Bids will be received until July 6 for constructing two bridges on Cart creek. County Auditor.

Janesville, Wis.—The new Indian Ford bridge will be constructed by the Wisconsin Bridge & Iron Co.

Aberdeen, S. D.—Bids will be received until July 7 for constructing three steel bridges. F. C. Hedger, County Auditor.

Zanesville, O.—A new iron bridge will be built over Salt creek to replace the wooden structure, which collapsed June 5.

Central City, Neb.—Bids will be received until July 14 for building a bridge across Prairie creek. William Cosner.

Mankato, Minn.—An iron bridge will be built at Vernon. The county commissioners have voted $300 for that purpose.

Pittston, Pa.—The Water Street Bridge company contemplates the erection of a new iron and steel bridge this summer.

Eight Mile Grove, Neb.—The question of constructing a free wagon bridge across the Platt river will be voted on July 7.

Plymouth, Ia.—The contract for a steel bridge over the Shell Rock river was awarded to N. M. Stark & Co. for $1,935.

Ft. Dodge, Ia.—Bids will be received until July 11 for constructing three iron bridges and two 20-foot bridges. County Commissioners.

Ellensburg, Wash.—Bids are asked until July 10 for constructing a wagon bridge over the Yakema river. J. M. Baird, County Auditor.

Cleveland, O.—A new steel bridge, to cost approximately $2,500, is favored to replace the Newburg bridge.

Appleton, Wis.—The streets and bridges committee of the city council will recommend the building of a new draw bridge at John street.

Milwaukee, Wis.—City Engineer Benzenberg estimates the cost of a bridge to Jones Island, at the foot of Greenfield avenue, at $28,000.

Leando, Ia.—Petitions are being presented to the Board of Supervisors asking for a bridge across the river between Douds and this town.

Cleveland, O.—Sealed proposals will be received until July 15 for constructing a bridge in Bridge street, between Gordon and Waverly avenues. Certified check, $500. D. E. Wright, Director Public Works.

Norwich, N. Y.—The contract for building a new iron bridge across the Chenango river was awarded to the Groton Bridge Manufacturing company for $3,000.

Healdsburg, Cal.—The citizens of Hilton contemplate taking measures to have a bridge erected this year to connect Forestville and Hilton.

Mt. Pleasant, Ia.—The county board has decided to build two bridges across the Chipuaqua river, one at Millspaugh and one at Boyleston.

Menasha, Wis.—Sentiment is divided on the proposed Mill street bridge, and it is not yet decided whether it shall be of wood, iron or stone.

Green River, Wyo.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for building a wagon bridge across the river for $5,435.

Williams, Cal.—Bids are asked until July 10 for constructing a 400-foot pile bridge on the road leading from Maxwell to the Sacramento river. County Clerk.

Trempealeau, Wis.—Chairman Gibbs of the town board, has condemned a bridge in the vicinity of Centerville, and it will be replaced with an arch bridge.

Redfield, S. D.—Bids will be received until July 7 for constructing iron or combination bridges in Ashton, Buffalo and Prairie Center townships. Ed. Borwell, County Auditor.

Chicago, Ill.—Plans and specifications for the proposed viaduct connecting the North and South Sides are about completed. The viaduct will extend from Washington to Indiana streets.

Rolfe, Ia.—Messrs. J. J. Bruce, P. Doyle and L. E. Lang have been appointed a committee to consider the construction of a bridge across the Des Moines river east of this town.

Whitestown, N. J.—A resolution has been adopted providing that a committee prepare plans and invite bids for a bridge over Peddie Lake. Mr. Hutchison is chairman of the committee.

Plattsmouth, Neb.—An election to vote bonds for the erection of a wagon bridge over the Platte river at Cedar Creek, will be voted on July 7. The estimated cost of the bridge is $8,000.

Plainfield, N. J.—Committees have been appointed to consider the advisability and probable cost of building a new iron bridge on South street, Elizabeth and on Willow Grove road.

Kansas City, Kas.—A new steel bridge will be built at the site of the city's old structure at Central avenue at the expense of the Meropolitan Street Railway company. Estimated cost, $53,000.

Freeport, Ill.—Messrs. J. R. Young, Jas. Rezner and A. A. Geiger have been appointed a committee to begin the re-construction, at once, of the thirteen bridges which were restroyed recently at Rock City.

Langdon, N. D.—Bids will be received until July 6 for constructing a bridge across Pembina river at Fish Trap. Bids are wanted on both iron and combination bridges. H. D. Alleet, County Auditor.

Elizabeth, N. J.—A new iron bridge has been favorably voted on by the freeholders to cross the river at South street; estimated cost, $6,000. Frederick Miller.

Florence, Wis.—The bridge across the outlet to Patton lake has been destroyed by fire and it is doubtful if the town will be able to build a new one this year.

Ottawa, Ill.—The Illinois river bridge has been pronounced dangerous, and will have to be rebuilt or remodeled. Arrangements will be made at once for its repair.

White Pigeon, Mich.—The Wrought Iron Bridge company, Canton, O., has been awarded the contract for constructing a steel bridge across White Pigeon river for $1,180.

Aitkin, Minn.—The construction of a bridge across the river at McNurdee's is contemplated. The council is undecided whether to build a wooden or an iron bridge.

Syracuse, N. Y.—The Wrought Iron Bridge company, Canton, O., was awarded the contract for building a steel girder bridge across Onondaga creek for $7,540.

Stevenson, Wash.—Bids are asked, until July 6, for constructing an 80-foot iron or steel bridge and two 60-foot approaches over the Wind river. C. G. Green, Clerk County Board.

New York, N. Y.—The commissioner of public works has been granted permission to spend $5,000 on preliminary plans for the proposed Kingbridge road bridge over the Harlem river.

Little Rock, Ark.—Sealed proposals will be received until July 15 for constructing a highway bridge across the Arkansas river at Main street. W. A. Compton, County Judge. Keepers & Thacher, Detroit, Mich., Engineers.

Cincinnati, O.—Sealed proposals will be received until July 15 for a temporary aqueduct over Mitchell avenue, at the intersection of Miami canal, Millcreek township. John Breen, President Board Hamilton County Commissioners.

Olivet, S. D.—Sealed bids will be received until July 6 for the construction of a twenty-foot span bridge with ten-foot approaches on each side. Bidders to submit plans and specifications. Paul Dekker, County Auditor.

Philadelphia, Pa.—The contract for constructing a bridge over the Schuylkill river at Strawberry Mansion, for the Fairmount Park Transportation company, has been awarded to the Franklin Engineering company for about $485,000.

Taunton, Mass. — (Special.) — Luther Dean, City Engineer, says the contract for building a new bridge across the Taunton river, between the towns of Berkley and Dighton, has been awarded to Beattie & Wilcox for $23,500.

Miller's Fall, Mass.—A petition from the citizens of Erving and Montague has been made to the board of county commissioners for a bridge over the Miller's river at the same location where one was washed away recently.

Binghamton, N. Y.—(Special.)—H. Ward says that an election will be called on the question of raising $65,000 to build a new bridge in place of the suspension bridge over the Chenango river at Ferry street; span about 360 feet.

Providence, R. I.—The board of aldermen voted June 18 for the construction of a new bridge and retaining walls at Market square, by directing the city solicitor to apply to the general assembly for permission to issue $325,000 of bonds.

Camden, N. J.—Sealed proposals will be received until July 6 for the construction of Champion road causeway over Newton creek, from Hadden township to Gloucester City. Certified check, $200. Jacob Price, Chairman Bridge Commissioners.

St. Charles, Mo.—A committee composed of Mayor Ringe, Theo. Brueure and Albert Runge, aldermen, has been appointed to thoroughly investigate the cost of construction and other details for the proposed bridge at this point.

West Superior, Wis.—The contract for constructing a double-deck draw bridge across the bay connecting Duluth and Superior was awarded to Alex T. McGraw, of Philadelphia, Pa. The probable cost is estimated at $350,000.

Menasha, Wis.—The bridge committee of the common council, after making a thorough examination of the bridge across the Fox river above Menasha dam, has condemned the bridge and will have erected in its place a first-class iron bridge.

Atchison, Kas.—Plans will be made by City Engineer Giddings for a new pile bridges across White Clay creek on Fourth street, to replace the old wooden bridge. The new bridge will be built the full width of the street, which is about to be paved.

Buffalo, N. Y.—The estimated cost of the proposed bridge for Florida street, including abutments, is about $6,700. The council will also order a new iron bridge constructed over Cazenovia creek at Cazenovia street; estimated cost, $25,000.

Long Island City, N. Y.—A committee will be appointed to confer with the Brooklyn officials with reference to engaging an engineer to prepare plans and specifications for removing the bridge over Newtown creek at Vernon avenue, and erecting a new structure.

Mankato, Minn.—Bids will be received until July 13 for constructing a stone double box culvert at the outlet of Madison lake; check, $50; also, for a stone culvert across ravine in the town of Garden City; check, $50. Robert S. Hughes, Chairman Board of County Commissioners.

Westmoreland, Kas.—Sealed bids will be received until July 9 for building two bridges, as follows: One 40-foot span, four panel, 14-foot roadway, iron bridge across Floberg ravine; one 50-foot span, four panel, 14-foot roadway, iron bridge. Frank Davis, County Clerk.

Cleveland, O.—The park board, the Glenville council, the Little Consolidated Street railway and the county commissioners are considering a proposition to build a bridge jointly at the point where the culvert was washed out in St. Clair street. A new bridge of a permanent character is favored by all.

Lebanon, Ill.—A meeting held by the highway commissioners of Lebanon township and a committee of supervisors composed of Henry Marmle of East St. Louis, W. T. Crouch of Belleville and W. Keck of St. Clair township authorized the advertising for bids for an iron and stone bridge over Hawk river on the old Mascontah road.

Salt Lake City, Utah—Sealed proposals will be received until July 6 for the construction of abutments and superstructure of a 48-foot span highway combination bridge across the river Jordan, between the Sandy and the Draper bridge. Certified check, $100. C. E. Stanton, County Clerk.

Glassport, Pa.—A combination highway and railway bridge across the Monongahela river, between Mendelssohn and this city, is contemplated; estimated cost $175,000. The directors of the Pittsburg, Virginia & Charleston railroad and the United States Glass company are interested.

St. Clairsville, O.—Sealed proposals will be received until July 7 for erecting an iron superstructure for a bridge over Captina bridge, near Steinerville, in York township, to replace the presentation and wooden superstructure. All bidders will be required to submit bids for the new superstructure together with a bid for the old superstructure. J. A. Henderson, Auditor.

Painesville, O.—Sealed proposals will be received until July 3 for the construction of the substructure and superstructure of the highway bridge across Grand river on the line of Main street extended. Proposal for the substructure must be accompanied by a certified check for $2,000; superstructure, $5,000.

Philadelphia, Pa.—Director Thompson and Chief Webster recommend that about $350,000 of the $600,000 for new bridges, which is provided for in the proposed loan, be appropriated for the completion of three bridges which are now only partially constructed: The Thirty-third street, the Wyoming avenue and the Seventeenth street bridges.

PARKS.

Chariton, Ia.—The city park has been improved through the efforts of the Improvement Association.

Newark, N. J.—The purchase of property on Eighteenth avenue and S. Tenth street is advocated for a park.

Helena, Mont.—The citizens on the west side have suggested that the Hawthorne grounds be acquired and converted into a park.

Atlantic City, N. J.—Plans have been received for beautifying the city park, but it is not probable that the work will be done this year.

San Francisco, Cal.—The question of securing the old Jewish Cemetery lots for a public park will be brought before the board of supervisors.

Philadelphia, Pa.—An esplanade on the west side of the Schuylkill river, from below the Walnut street bridge to Bartram's Gardens, is proposed.

Memphis, Tenn.—The press is urging consideration of the park question, and calls attention to the manifold and manifest advantages of parks to a city.

Chattanooga, Tenn.—A fund has been started for beautifying the waste places. A plan has been completed by George M. Bradt, president of the park commissioners, for the decoration of the court house lawn.

Des Moines, Ia.—Plans have been prepared for the improvement of Kingman boulevard, from Twenty-fourth street and Cottage avenue west nearly two miles to Waveland Park.

Jersey City, N. J.—Mayor Wanser has secured an option on two pieces of land for public parks in accordance with a law of 1894, which gives the city power to buy property for parks.

Malden, Mass.—An appropriation of $100,000 has been given the Metropolitan park commission, and it is probable that a part of it will be used to complete the Malden boulevard across the marshes to Somerville and Cambridge.

East Orange, N. J.—The board of directors of the Orange Athletic Club has adopted resolutions approving the plan for boulevards through the Oranges, with cycle and bridle paths. The scheme will open a new thoroughfare from Newark to the Orange mountain.

Kansas City, Kas.—A park board will be organized by the citizens and after it is incorporated it will purchase property for park purposes and dedicate it to the city. The parks will be under the supervision of the park commission and park board jointly.

Muscatine, Ia.—The establishment of a park along the river, from Iowa avenue to Pappoose creek, is contemplated. A committee, consisting of Mesdames Henry Jayne, S. Zimmerman and B. E. Lilly, visited Davenpprt recently to consult a landscape artist regarding the river park.

Chicago, Ill.—A delegation of property-owners on Oakley avenue called on the council committee on streets and alleys west, to ask that Oakley avenue, between Washington boulevard and Twelfth street boulevard be converted into a boulevard and turned over to the control of the West Park Board. It will then be paved with asphalt.

New Brighton, N. Y.—The public improvements committee of the Staten Island Chamber of Commerce, has called attention to the urgent need of taking immediate steps to establish a park system throughout the island. The appointment of a park commission is urged. The report and the recommendations have been favorably acted upon.

Kansas City, Mo.—Mr. Thomas H. Swope, one of this city's oldest inhabitants, has donated 1,314 acres of ground to the city for park purposes. The only conditions exacted by the donor are that the land be named "Swope Park," and that the city expend, during the next ten years, at least $5,000 a year in improving the grounds.

Newark, N. J.—The park commission has accepted the bid of B. M. and J. F. Shanley of Philadelphia to supervise the work of laying out and grading Branch Brook park. Two bids were submitted for this work and under the first proposition twenty-three bids were received, all of which were rejected. The commission then decided to send out new proposals to six of the first bidders who seemed most likely to offer the terms desired, with the result that B. M and J. F. Shanley's bid was accepted. The Fifth Ward Improvement Association has decided to deed to the city for a public park a triangular strip of land between Alden and Cleveland streets and the Watchung railroad.

Pueblo, Col.—A plan is being considered which, if carried out, will give this city several beautiful parks. The improvement committee's plan is to divide the city into park districts, each entirely separate from the other, and supported by levies made upon the district. Four districts will be sufficient, it is thought, as each would take in valuable property.

STREET SPRINKLING.

Long Branch, N. J.—The contract for sprinkling streets for the season of 1896 has been awarded to L. S. Koehler & Son for $2,255.

Pittsfield, Mass.—An appropriation of $3,000 has been voted for street sprinkling and street cleaning and for the care of trees. Two carts will be put on for sprinkling purposes.

Evansville, Ind.—The board of public works awarded street sprinkling contracts June 8, as follows: Walnut street, Pritchett & Gumberts, $21.90 per 1,000 square feet; Franklin and First streets, Igenman & Hollenbach, $18 per 1,000 square feet.

Meriden, Conn.—A special committee, consisting of Councilmen Bicknell, Gaines, Kennard, Schenck and Hinsdale, was appointed by Mayor Coe, June 1, to investigate the various systems of street sprinkling and report to the council not later than the first Monday in October, the result of their investigation, together with such charter amendments and by-laws as they deemed necessary.

New Haven, Conn.—The board of public works received an opinion from Corporation Counsel Ely June 11 "that top-dressed or hardened streets did not come under the designation of paved streets, and advised that property-owners could not be assessed for the watering of the same." Exception to the ruling of the corporation counsel was taken by the commissioners, who passed a vote authorizing the city engineer to advertise for bids on the street sprinkling work for all streets top-dressed with brick, stone or Telford pavement. Bids were received for sprinkling June 15, and the contract will cover about forty miles of streets, including all paved streets in the city.

STREET CLEANING.

Iowa City, Ia.—The purchase of a street sweeper is contemplated.

Camden, N. J.—The contract for cleaning streets and collecting garbage for the ensuing year has been awarded to B. F. Sweeten & Son for $16,000.

Washington, D. C.—Bids were opened June 15 for scraping and cleaning Pennsylvania avenue and other streets by hand. William Ryan was the only bidder at $22 per day. For cleaning paved alleys Albert Daggett was the only bidder at 40 9-10 cents per square yard, or 10 per cent. above actual cost of work. For cleaning unpaved streets and alleys bids were received as follows: M. J. Foley, $67.45 per day; James Frawley, $73 per day; Albert Daggett, $68.85 per day; Horn & Son, $70.80 per day.

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